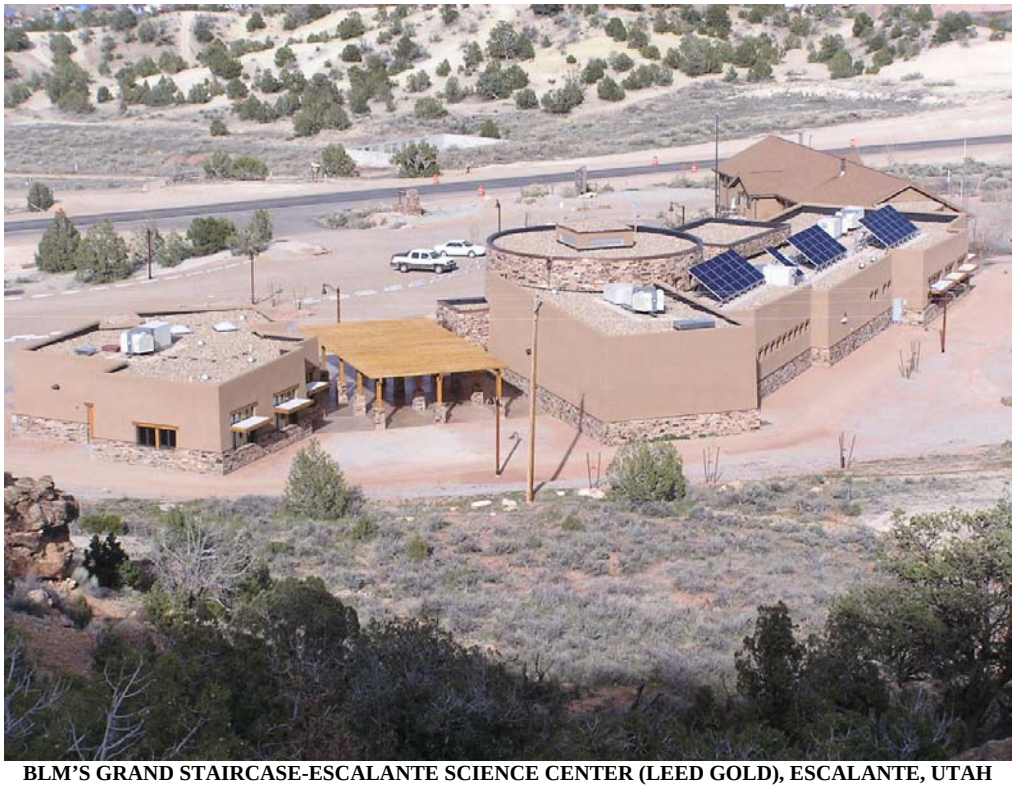
Department of the Interior

Federal Leadership in High Performance and Sustainable Buildings Implementation Plan



BLM'S GRAND STAIRCASE-ESCALANTE SCIENCE CENTER (LEED GOLD), ESCALANTE, UTAH

January 2007

Sustainable Building Design Working Group

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EXECUTIVE SUMMARY

On January 24, 2006, The Department of the Interior (DOI) signed the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (MOU) to commit to Federal leadership in implementing common strategies for planning, acquiring, siting, designing, building, operating, and maintaining high performance and sustainable buildings. Twenty one agencies signed the MOU. The MOU establishes a common set of sustainable guiding principles to: 1) employ integrated design principles; 2) optimize energy performance; 3) protect and conserve water; 4) enhance indoor environmental quality; and 5) reduce environmental impact of materials. These Guiding Principles will help DOI achieve the MOU goals:

- **Reduce** the total ownership cost of facilities;
- **Improve** energy efficiency and water conservation;
- **Provide** safe, healthy, and productive built environments; and
- **Promote** sustainable environmental stewardship

Each Bureau or Office shall prepare a High Performance and Sustainable Buildings Action Plan (Bureau Action Plan), which is integral to the successful implementation of the MOU guidelines. This Action Plan implements the *Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings* and will be updated annually, and reported on semiannually to promote continuous improvement toward the goals. Each Bureau Action Plan will contain, at a minimum, sections describing an implementation process, execution objectives, and performance reporting. Reported performance will be used to document Bureau or Office accomplishments for the OMB Scorecards.

(Signature of Environmental Executive (EE))
(Title/Office)

Signature of Energy Executive (EE))
(Title/Office)

Signature of Real Property Executive (RPE))
(Title/Office)

Signature of Facilities and Maintenance (FME))
(Title/Office)

Signature of Chief Acquisition Officer (CAO))
(Title/Office)

Signature of Chief Financial Officer(CFO))
(Title/Office)

1. INTRODUCTION

With increasing concerns about limited resources, increasing fuel and energy costs, dependency on foreign oil, increasing world-wide energy demands, and environmental change; sustainable facility design is a national priority. Facilities and buildings are major consumers of energy in this country.

Responding to these pressures, the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (MOU) (http://www.wbdg.org/sustainablemou/) was approved in January 2006 and set goals and established a group of guiding principles for each Federal Agency to follow when considering new construction or major renovation.

The Department of the Interior (DOI) has over 40,000 owned buildings. Given the Department's large inventory of facilities it becomes essential that DOI incorporate the MOU strategies into sustainable design as it builds new facilities and renovates its existing ones.

Sustainability is an environmental stewardship strategy that begins by considering whether a new facility is truly needed (http://www.doi.gov/pam/cpic/executivesummary.pdf). Sustainable construction is defined as "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles." Sustainable building designs aim to lessen their impact on our own environment through energy and resource efficiency.

Buildings that are healthy for the environment are healthy for people, as well. In some climates, buildings designed for daylighting and natural ventilation may reduce energy use while exposing people to beneficial natural light and fresh air.

High Performance and Sustainable measures that apply everywhere include integrated design, energy conservation, water conservation, environmental quality, and materials recycling. These measures form the basis of the MOU's guiding principles, which will structure each Bureau's required sustainable program. Sustainability will be incorporated into each Bureau's Asset Management Plan and Environmental Management System.

The Department of Interior, a signatory to the MOU, builds on a long history of sustainable design by its Bureaus, as they performed their conservation related missions. The Bureau of Land Management (BLM) spearheaded efforts on the co-location of facilities between the BLM and the U.S. Forest Service to promote sustainability and the leasing of green facilities over available standard facilities. The new Grand Staircase-Escalante National Monument's Escalante Science Center received the U.S. Green Buildings Council's Leadership in Energy and Environmental Design (LEED) Gold rating for innovative techniques to reduce energy and water use -- 40 percent less energy than a building of normal construction.

The National Park Service's commitment to sustainable principles has its origins in its fundamental preservation mission and was begun in the early 1990's, and took public form in Principles of Sustainable Design (http://www.nps.gov/dsc/dsgncnstr/gpsd/), an NPS publication which was "intended to direct park management philosophy. Its goal is to provide a basis for achieving sustainability in facility planning and design, emphasize the importance of biodiversity, and encourage responsible decisions." A fine example of this type of design is the Zion Canyon Visitor

Center at Zion National Park, Utah – a Federal Energy Saver Showcase that has been shown by the Department of Energy to be one of the best examples of sustainable, high-performance architecture.

The U.S. Fish and Wildlife Service was an innovator related to the incorporation of passive solar principles in its facility designs, such as at the National Conservation Training Center, West Virginia. In addition, its eleven Federal Energy Saver Showcases and eight Federal Energy and Water Management Award-winning facilities show the way to sustainability.

The Bureau of Indian Affairs has made a concerted effort to achieve certification in all their new facilities. In 2004, the Baca/Dlo ay azhi Community School became the first LEED™ certified building in New Mexico and the first for the Department of the Interior, nationwide. In 2005, First Mesa Elementary School in Polacca, Arizona became the second LEED™ certified school for BIA. Four additional projects are registered with the U.S. Green Building Council and are in review.

Two keys to the successful implementation of the Sustainability Action Plan are to incorporate policy into contract language and develop procedures to verify that the policy is carried out on all future major appropriate, building projects.

Every Bureau or Office within the Department has strived to incorporate sustainable practices on their own. The new scorecards and MOU guidance are now requiring each Bureau or Office to track and incorporate sustainability in all aspects of the construction and rehabilitation areas.

Definitions

"Major, appropriate buildings" means all occupied buildings with a construction cost of greater than or equal to $2 million, such as visitor centers, administration or structures that have measures of certification through LEED, Green Globes, or approved alternative.

"Appropriate buildings" means buildings where existing measures of sustainability exist for the building type e.g. LEED NC, EB. Buildings where certification may not be applicable, for example are; significant historical buildings constrained by cultural resource or State Historical Preservation Officer requirements, enclosed storage buildings, maintenance shops, small public restrooms etc.

2. IMPLEMENTATION

2.1 Bureau Sustainable Building Program

Each Bureau or Office will be required to establish a Bureau or Office sustainable building program for all new construction and major renovation projects, using the MOU guidelines and recording their accomplishments on two Office of Management and Budget (OMB) Scorecards (www.doi.gov/greening/newPMAscorecards/index.html):

- Environmental Stewardship (Attachment 1)
- Energy Management (Attachment 2)

This document will establish a system of measures to meet the required performance criteria of both scorecards. The components of this measurement system are:

- Performance (See Section 4)
- Bureau Action Plans (See Section 5)

Formal measurement of sustainable performance for use in completing OMB scorecards will be required on major, appropriate buildings. The foundation of measurement will start with considering certification of all new major construction and renovation projects using LEED (www.usgbc.com), the Green Globes process (www.thegbi.com), or other approved equivalent.

Facilities not appropriate for certification, regardless of cost, still must consider using sustainable construction and green building processes.

2.2 DOI and Bureau Sustainability Team Development

The Asset Management Team will establish a cross-functional DOI Sustainability Team. The DOI Sustainability Team will be comprised of representatives of Bureaus and Departmental Offices with skills and knowledge in the following areas: asset planning, facilities management, energy management, environmental management, or safety.

In addition to participating on the DOI Sustainability Team, each Bureau or Office shall establish a Bureau Sustainability Team. Bureau Sustainability Teams shall prepare a Bureau Sustainability Action Plan to implement MOU goals and meet the performance standards in the OMB Environmental Stewardship and Energy Management Scorecards. Bureau Sustainability Teams will include subject matter experts in facilities management, engineering/design, or contracting. The Sustainability Action Plan shall be included in Bureau or Office's Asset Management Plans and Environmental Management Systems.

Among other duties, the Bureau Sustainability Team shall develop an internal process for consideration of necessary project variances to Departmental and Bureau Building Performance Goals. Bureau or Offices will collect and report annually on project variances granted for new major, appropriate projects on Departmental Performance Goals to the Department.

2.3 Capital Planning and Investment Control

The established Capital Planning and Investment Control (CPIC) and Investment Review Board (IRB)/ Development Advisory Board of each Bureau or Office will verify the incorporation of the new Action Plan criteria into each new project submission. The boards were created to review and track major investments and to ensure new projects meet not just DOI's mission requirements but are cost effective and sound investments. The incorporation of the new MOU criteria will not only ensure that the new investments meet the desired cost savings, but provide a healthy working environment, improve energy savings, and conserve valuable water resources. The Office of Management and Budget (OMB) has included new scoring criteria for energy and high performance for all new project submissions. New facilities will now add additional points to the final project scoring for projects that include energy and high performance as a part of their scope of work. All submissions shall include budgets sufficient to fulfill MOU design principles, fulfill sustainability

performance goals, commissioning, and green building certification (when deemed appropriate by the Bureau or Office).

2.4 Contract Language

Beginning in FY 2007, Bureau or Offices will ensure that contractors incorporate Guiding Principles for High Performance and Sustainable Buildings into their designs of major, appropriate facilities. Contracts shall be written to include measures that certify MOU project performance criteria identified under Section 3 are fully met.

Many Bureau or Offices are encouraging the use of design-build contracts. Design-build contracts shall integrate sustainable design procedures and performance goals into the procurements, so as to take advantage of opportunities to improve cost and sustainable performance. Integration of sustainable design procedures with constructability reviews is encouraged.

2.5 Sustainable Specification Language

Bureaus will modify construction specifications for all major, appropriate projects to meet statutory requirements, including RCRA, the Energy Policy Act of 2005, the MOU, and appropriate Executive Orders.

Supplemental green guide specifications have been prepared for use on federal building projects. The supplemental specification language has been formatted and organized according to the Construction Specifications Institute's MasterFormat. The specification language is written so that it covers each of the required areas as is stated in the Energy Policy Act of 2005, Federal Leadership in High Performance and Sustainable Buildings MOU, and Greening of Government Executive Orders. The Federal Green Construction Guide for Specifiers can be accessed through the web site http://www.wbdg.org/design/greenspec.php .

The Bureau or Office's are encouraged to use the language where appropriate when writing contract language for any major facility and for all projects regardless of size, as determined by Bureau or Office policy.

2.6 Incorporating the MOU Guidelines into Space Leases

In accordance with Executive Order 13123, Bureau or Offices entering into leases, including the renegotiation or extension of existing leases, shall incorporate lease provisions that encourage energy and water efficiency wherever life cycle cost-effective. Build-to-suit lease solicitations shall contain criteria encouraging sustainable design and development, energy efficiency, and verification of building performance. Bureau or Offices shall include a preference for buildings having the ENERGY STAR® building label in their selection criteria for acquiring leased buildings. For leases of 10,000 s.f. or more in existing buildings (e.g., not build-to-suit), all bureaus and offices must make use of model sustainable lease language developed by the General Services Administration, or use bureau-developed equivalent language.

2.7 Certification

Each Bureau or Office shall determine a methodology to measure the "sustainability" achieved during the design and construction of major, appropriate facilities. A commercially available evaluation system such as LEED, Green Globes, or other approved equivalent, shall be used to measure project success. At a minimum, all major, appropriate facilities should achieve a LEED "Certified" rating or one green globe or greater if using Green Globes, or approved equivalent.

3. DESIGN & EXECUTION

The MOU identifies a set of Guiding Principles of Sustainability. Starting in FY 2007, the guiding principles shall be employed by all DOI Bureau or Offices when designing or rehabilitating major, appropriate buildings. The guiding principles are separately discussed in the following sections. Achieving the standards of the MOU will help in meeting the goals of the Energy Management and Environmental Stewardship Scorecards. The MOU standards are minimum goals that are not to be considered exclusive, but should be used in helping to develop project-specific criteria to consider when acquiring new facilities and constructing to the green standard using LEED, Green Globes or approved alternative.

3.1 Employ Integrated Design Principles

The employment of integrated design principles is the use of a collaborative, integrated planning and design process that initiates and maintains an integrated project team that manages a project from inception to project completion. The team establishes high performance and sustainable goals and ensures the incorporation of these goals throughout the complete life cycle of the project through disposition.

3.1.1 Integrated Project Design Team

For all project design starts beginning in FY 2007, all new major, appropriate buildings will be led by an integrated project team, as defined by the Bureau or Office, which would include sustainability, safety, environmental management, and at least one "Green Building" professional.

3.1.2 Building Performance Goals

All Bureau or Offices will define performance goals to be used by integrated project design teams in designing new major, appropriate projects. These performance goals must address siting, energy, water, materials and indoor environmental quality and consider all stages of a building's life cycle (as expanded upon later). These performance goals must be set to ensure that all new major, appropriate projects achieve certification using the LEED, Green Globe or an approved alternative process.

3.1.3 Site Planning

Bureau or Offices shall establish building performance goals for site planning using criteria included in LEED or Green Globes or an approved alternative process.

3.1.4 Design Sustainability Reviews

The “Green Building” certification process establishes a review process throughout a project’s life; however, for projects that would not be subject to certification, sustainability reviews need to be conducted on all projects regardless of size. Bureau or Office design processes shall include sustainability reviews at appropriate milestones early and throughout the design process to determine if the project design is on track to meet minimum Departmental, Bureau, and project performance goals. At least one sustainability review will be performed by a team to include design peers and outside sustainable building design experts. This may be accomplished through a total building commissioning process or through appropriate value-based decision-making.

3.1.5 Building Commissioning

Building commissioning is a systematic approach to improving system performance, operation & maintenance, indoor air quality & thermal comfort, and energy efficiency in both new and existing buildings. Commissioning goes beyond testing, adjusting, and balancing (TAB) and traditional inspections.

ASHRAE Guideline 0-2005, The Commissioning Process, defines commissioning as "a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria". Commissioning involves functional testing to determine how well the building systems work together and if the systems meet the original design intent.

3.1.5.1 Commissioning Goals

Bureau or Offices shall employ total building commissioning practices tailored to the size and complexity of the building and its systems components. Commissioning should include a designated commissioning authority, inclusion of commissioning requirements in construction documents, a commissioning plan, and a commissioning final report. Bureau or Offices shall follow the process as outlined in *ASHRAE Guideline 0-2005, The Commissioning Process (www.ashrae.org). Guideline 0-2005* presents a standard process that can be followed to commission any building system that may be critical to the function of a project.

The cost of commissioning should be a line item in the project cost estimate. The average cost of total building commissioning, from design through warranty, varies from 1% - 2.5% of the construction cost depending on the complexity of the facility.

3.1.5.2 Commissioning and Green Buildings

Many owners assume that the green certification process and the commissioning process are identical. Coordination of the green certification process is beyond the scope of the commissioning provider associated with a green project. Usually a project team member is appointed as the coordinator of the green certification process.

Sources available to help in understanding and adopting commissioning into a project acquisition plan include:

ASHRAE Guideline 0 - 2005: The Commissioning Process—the industry-accepted Commissioning Guideline. Includes the Total Building Commissioning Process as defined by National Institute of Building Sciences (NIBS). www.ashrae.org

National Institute of Building Sciences (NIBS) Commissioning Process Guideline 0. www.nibs.org

LEED-NC Version 2.2 Reference Guide, U.S.Green Building Council. www.usgbc.org

The Building Commissioning Guide, U.S. General Services Administration, 2005. www.wbdg.org

3.2 Optimize Energy Performance

Optimizing a building's energy performance requires an integrated design approach to minimize the building's energy consumption while meeting all the occupants' needs. Integrated design is an important aspect of optimizing energy performance, including equipment selection, because decisions made in one area will affect others. The building's design is only the first step to optimizing its energy performance. The building must also be constructed as designed and commissioned on a regular basis. Measurement and verification of the building's actual energy performance also plays an essential role in optimizing its energy performance.

3.2.1 Building Performance Energy Targets

Energy performance targets can be set for a building design and compared to the estimated energy consumption. Integrated project management teams shall establish a whole building performance target for a given project that is based on the intended use, occupancy, operations, anticipated plug load and other energy demands, consistent also with minimum requirements included in LEED or Green Globe. The ENERGY STAR® Target Finder referenced in the MOU provides an energy performance target rating for whole building energy use. The Target Finder is an internet-based tool (http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder) that provides a realistic energy consumption target for the building designs as compared to similar buildings nationwide. The Target Finder displays the annual energy use corresponding to the targets selected. The target serves as a reference for comparing energy strategies and deciding the best technologies and practices for achieving energy performance goals. There are alternate sources such as COM*check-EZ* (http://www.enertgycodes.gov/comcheck/), DOE2 (http://www.doe2.com) and eQUEST that can help in determining energy performance.

3.2.2 Energy Star Rating

New project designs starting in FY07 shall achieve at least a 75% rating using the Energy Star® Building certification for new construction and at least 60% rating for major renovation. This can be achieved by establishing a whole building performance target that takes into account the intended use, occupancy, operations, plug loads, other energy demands, and design to earn the ENERGY

STAR® targets for new construction and major renovation where applicable. These targets may be determined using the ENERGY STAR® Target Finder tool.

3.2.3 Energy Intensity Reductions

For new construction, design buildings to achieve energy consumption levels that are at least 30 percent below the levels established in by the 2004 International Energy Conservation Code for residential buildings or the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) (www.ashrae.org) and the Illuminating Engineering Society of North America (IESNA) Standard 90.1-2004, Energy Standard for Buildings Except Low-Rise Residential. Reduce the energy intensity by 20 percent below pre-renovations 2003 baseline for major renovations.

3.2.4 Measurement and Verification

Section 103 of the EPAct 2005 requires that electric meters be installed in all Federal buildings in accordance with Bureau Metering Implementation Plans, completed in June 2006, and updated annually. Starting in FY 2007, electric meters shall be installed in all major, appropriate buildings that are new construction or major renovations.

- Actual performance data from the first year of operation shall be compared with energy design targets. After one year of occupancy, measure all new major installations using the ENERGY STAR® Benchmarking Tool for building and space types covered by ENERGY STAR®.

- Data and lessons learned from major, appropriate sustainable buildings will be entered into the Department of Energy's High Performance Building Database at (www.eere.energy.gov/femp/highperfomance/index.cfm). A/E's should provide information to the project manager to facilitate data input.

3.2.5 Renewable Energy

"Renewable energy" means electric energy generated from solar, wind, biomass, landfill gas, ocean (including tidal, wave, current, and thermal), geothermal, municipal solid waste, or new hydroelectric generation capacity achieved from increased efficiency or additions of new capacity at an existing hydroelectric project.

Section 203 of EPAct 2005 sets goals for renewable electricity consumption by the federal government to be no less than 3 percent in fiscal years 2007 through 2009, 5 percent in fiscal years 2010 through 2012 and 7.5 percent in fiscal year 2013 and thereafter. The renewable energy consumption goals can be achieved by on-site generation and use at a Federal facility (such as photovoltaic systems, wind turbines, ground source heat pumps); purchasing renewable energy (green power) from utility companies for use at a Federal facility, and; through the purchase of renewable energy certificates. Each Bureau or Office shall strive to meet the renewable energy consumption goal. Annual crediting guidance towards these goals will be provided by the Department of Energy.

The DOI goal will be to increase the use of both on-grid and off-grid renewable energy generation systems, including solar hot water, solar electric, solar outdoor lighting, small wind turbines, fuel cells, and other alternatives, where such systems are life-cycle cost-effective and offer benefits including energy efficiency, pollution prevention, source energy reductions, facility energy reliability, security enhancement, avoided infrastructure costs, or expedited service.

3.2.6 Energy Performance Technical Guidance

Included below are areas of consideration in the area of Optimizing Energy Performance. Each area is discussed in detail in Attachment 4.

Passive Solar Design
Earth Shelter Design
Photovoltaic
Duct Design
Energy Recovery
GeoExchange Systems
Energy Efficient Lighting
LED Exit Signs
Radiant Barriers
Solar Systems
Gas Water Heating and Air Conditioning
Fan Usage
Ventilator Appliances
Direct Digital Controls for HVAC Systems
Occupancy Sensors

3.3 Protect and Conserve Water

All new construction or renovation of major, appropriate buildings shall develop water management plans and incorporate Best Management Practices (BMPs) for water conservation. BMPs include a variety of technologies and techniques used to save water and associated energy costs. BMPs for water conservation for both indoor and outdoor water consumption can be found at http://www.eere.energy.gov/femp/technologies/water_fedrequire.cfm.

3.3.1 Indoor Water Conservation

Employ strategies that in aggregate use a minimum of 20 percent less potable water than indoor water use baseline calculated for the building, after meeting the Energy Policy Act of 1992 fixture performance requirements.

3.3.2 Outdoor Water Conservation

Reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means by using water efficient landscape and irrigation strategies including water reuse and recycling.

Projects designs and construction practices shall reduce the amount and consolidation of storm water runoff using best management practices and the use of bio-filters for treatment of storm water runoff and sediment control, and shall be in compliance with the National Pollution Discharge Elimination System requirements (NPDES).

3.3.3 Water Conservation Technical Guidance

Included below are areas of consideration in the area of Water Conservation. Each area is discussed in detail in Attachment 4.

Water Pervious Materials
Waterless Urinals
Indoor Water Conservation
Xeriscape Design
Greywater Use
Harvested Rainwater

3.4 Enhance Indoor Environmental Quality

The Environmental Protection Agency (EPA) has determined that the average person spends 90% of their time indoors, and the indoor air quality and working environment can have a substantial effect on the person's health and work ethic. Every effort should be made to enhance the environmental quality of the DOI employee working indoors. This section will discuss five areas of the MOU that will have a measurable effect of the indoor working environment. Those areas include: ventilation and thermal comfort; moisture control; daylighting; low-emitting materials; and protection of indoor air quality during construction.

3.4.1 Ventilation and Thermal Comfort

Bureau or Offices shall ensure adequate ventilation and thermal comfort in major, appropriate buildings by meeting current ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone
Meet ASHRAE Standard 62.1-2004 Ventilation for Acceptable Indoor Air Quality.

3.4.2 Moisture Control

Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage and mold contamination.

3.4.3 Daylighting

Major, appropriate buildings shall achieve a minimum of daylight factor of 2 percent (excluding all direct sunlight penetration) in 75 percent of all space occupied for critical visual tasks. Provide automatic dimming controls or accessible manual lighting controls, and appropriate glare control.

3.4.4 Low Emitting Materials

Designs and constructions specifications for all new building construction and renovation shall specify materials and products with low pollutant emissions, including adhesives, sealants, paints, carpet systems, and furnishings.

3.4.5 Protect Indoor Air Quality during Construction

Designs of major, appropriate buildings shall follow the recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction (1995). Interior facilities also should make use of the *Good Practices for Maintaining Acceptable Indoor Air Environmental Quality During Construction and Renovation Projects*, published by national Institute for Safety and Occupational Health (NIOSH), November 2005.

Conduct a minimum 72 hour flush out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent after construction and prior to occupancy. Continue flush-out as necessary to minimize exposure to contaminants from new building materials after occupancy.

3.4.6 Indoor Environmental Quality Technical Guidance

Included below are samples to consider in the area of Enhanced Indoor Environmental Quality. Each area is discussed in detail in Attachment 4.

Programmable Thermostat
Daylighting
Electromagnetic Fields
Paint, Stain, and Varnishes and Adhesives
Non-toxic Termite Control

3.5 Reduce Environmental Impact of Materials

There are many ways to minimize the environmental impact of materials on the environment. Rather than building anew, recycle or adaptively reuse a building for a new purpose. The designing of flexible interiors that can be converted to other uses reduces the need for redesign and reconstruction of interior spaces. Encourage visitor and employee recycling through well-placed and marked containers and awareness programs. Seek building materials with high recycled content and low "embodied energy". The consideration of using as many green products as possible is encouraged for any new facility or major renovation. The DOI Greening the Interior Green Product webpage (www.doi.gov/greening/index.html) provides an excellent resource for the procurement of green products.

3.5.1 Recycled Content

Use products meeting or exceeding EPA's recycled content recommendations for EPA-designated products. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project.

3.5.2 Biobased Materials

Use products meeting or exceeding USDA's biobased content recommendations for USDA-designated products. Use biobased products made from rapidly renewable resources and certified sustainable wood products for other products.

3.5.3 Construction Waste

Identify local recycling and salvage operations that could process site related waste during a project's planning stage. Program the design to recycle or salvage at least 50 percent construction, demolition, and land clearing waste, excluding soil, where markets or on-site recycling opportunities exist.

3.5.4 Ozone Depleting Compounds

Eliminate the use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI or the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account life cycle impacts.

3.5.5 Environmental Impact of Materials Technical Guidance

Included below are areas of consideration in the area of Recycling and Building Materials. Each area is discussed in detail in Attachment 4.

Dimensional Lumber
Engineered Structural Products
Flyash
Non-wood Flooring
Roofing
Insulation
Cabinets
Compost
Biobased Products
Wood Treatment
Engineered Sheet Materials
Alternative Wall Construction
Wood Flooring
Structural Panels
Composite Materials
Straw Bale Construction
Construction Waste Recycling

4. PERFORMANCE

The performance of each Bureau or Office will be tracked and measured using the Environmental Stewardship and Energy Management Scorecards. Each Bureau or Office Action Plan should include how the Bureau or Office collects, tracks, verifies and reports its accomplishments for inclusion onto the scorecard. Both scorecards are important in recording accomplishments towards achieving the requirements of Executive Order 13123 and the Energy Policy Act of 2005.

4.1 Measurement

The OMB Scorecard measures the DOI's quarterly and annual progress. DOI participated in the Sustainable Buildings Retreat and reached consensus with the other participating Agencies on the interim standards outlined below for only the year 2006, subject to further review within the Agency.

In 2007, a meeting of the participating MOU Agencies will be held to discuss progress to date and further define the sustainable design/green buildings goals for out-years.

This phased-in approach recognizes that sustainable design/green building is a relatively new issue without the structure and mandates of other environmental initiatives. Participating Agencies estimated the need for a multiyear timeline for program development and implementation that will be addressed in more detail once the MOU begins to be fully implemented in its first year.

5. BUREAU ACTION PLAN

Each Bureau or Office is required to develop a High Performance and Sustainable Building Action Plan to suit their mission, using this DOI Plan as a guide. Bureau or Office Action Plans will measure the Bureau or Office's commitment to implementation of the MOU Guiding Principles and the expectation of the Bureau or Office's progress in implementing the MOU. This plan is not intended to replace any existing policy in place but to augment such established policies using new metrics and reporting criteria, in accordance with the MOU and EPACT.

The Bureau or Office Action Plan (6.3) shall be completed by each Bureau or Office and submitted to the DOI by no later than October 1, 2007. Each Bureau or Office will be requested to report the individuals responsible for each part of the plan plus estimated completion dates for each of the actions. The Bureau Sustainability Team will collect and report the data to the DOI.

6. ATTACHMENTS

6.1 Attachment 1 -Environmental Stewardship Scorecard

The Environmental Stewardship Scorecard (www.doi.gov/greening/newPMAscorecards/index.html) contains two measurable criteria directly linked to sustainability. The first is Green Purchasing that is a comprehensive, written green purchasing plan that includes recycled content products, Energy Star/energy efficient products, biobased products, and environmentally preferable products; demonstrates compliance in representative acquisitions; audits compliance annually and develops corrective action plans to address shortcomings in GPP preference program. The second is the implementation of a Sustainability Design and Construction Plan. The requirement is to implement a sustainability program for green buildings that at a minimum requires sustainability design principles on all new construction and major renovations and is consistent with EPACT 2005 and EO 13123, and/or is implementing the MOU on Federal Leadership in High Performance and Sustainable Buildings (1/24/06) or equivalent.

6.2 Attachment 2 -Energy Management Scorecard

The Energy Management Scorecard (www.doi.gov/greening/newPMAscorecards/index.html) is more representative of the MOU criteria and follows the metrics very closely. The MOU is more inclusive and includes more reportable criteria, but the scorecard includes a reportable renewable energy metric that is not included in the MOU. The Bureau Action Plan requires the renewable metric to be added to the reporting criteria so that all areas are covered within the scorecard if the MOU criteria are met.

6.3 Attachment 3 -Action Item Checklist

The attached Action Item Checklist is included as a model format that the Bureau or Office's can use for reporting specific action items in the implementation of a Bureau Sustainable Program. The Action Item Checklist is represented through the Bureau or Office Action Plan and is to be completed by each Bureau or Office and reported back to the Department no later than 1 October 2007. The Action Item Checklist will include as a minimum the reporting measures in Section 3.

6.4 Attachment 4 - Technical Guidance

Technical Guidance for Implementing the MOU accesses 18 Core Guidance Topics and 17 Supporting Guidance subjects and associated documents. See http://www.wbdg.org/sustainablemou/ Additional Technical Guidance is attached to provide representative examples of what is available to the designer in meeting performance goals for new and existing facilities. The attached examples are not exclusive and every planning team should investigate all available green building sources for products and building techniques that may fit the proposed project.

6.5 Attachment 5 – EREE High Performance Database

The data base (www.eere.energy.gov/femp/highperfomance/index.cfm) is used as a lessons learned for every new major, appropriate project and is to be completed upon completion of the project.

Attachment 1
ENVIRONMENTAL STEWARDSHIP SCORECARD
Department of the Interior

	CURRENT STATUS (As of January 1, 2007)[1]		PROGRESS		COMMENTS
ENVIRON-MENTAL STEWARDSHIP **Agency Environmental Executive:** P. Lynn Scarlett, Deputy Secretary **Lead EOP Analysts:** Cyndi Vallina and Dana Arnold	 Red ↓	• EMS report card criteria met: __>70% green and < 5% red on 13148 facility metrics _(date)_ (G) __< 20% red on 13148 facility metrics _(date)_ (Y) • Green purchasing: __Agency has green purchasing plan (GPP), representative acquisitions, audit program, and corrective action plan if applicable _(date)_(G) _X_ Agency has partial GPP and representative acquisitions _2006_(Y) • Sustainable design/green bldgs[2]: __agency implementing program that meets statutory requirements and/or elements of the MOU on Sustainable Buildings _(date)_ (G) _X_agency developed program_12/06_(Y) • Sustainability program for electronic stewardship: __agency implementing _(date)_(G) _X_agency developed and/or signed the MOU on Electronic Stewardship _2006_(Y) • Compliance Management Plan and implementation strategy: __agency developed _(date)_ (G) _X_agency did not develop, but identified related initiatives, plans, and strategies _2006_(Y)	 Green	<u>Actions taken since July 1. 2006:</u> • 18 facilities self-declared EMS. • Partially adopted EO 13148 workgroup EMS metrics. • Continued development of GPP. • Guidance on including green purchasing in environmental compliance audits and EMSs in internal review. • Conducted GPP training for purchase card holders and contracting officials. • Completed a comprehensive draft sustainable building implementation plan (SBIP). • Completion of Draft Electronics Implementation Plan is in progress. • Did not formally reply to call letter – sent a copy of Report on Auditing Programs and Activities – audits are being conducted and tracked. <u>Planned actions for next six months:</u> • Six facilities will self-declare EMS. • Make progress on sites scoring red on EO 13148 report card. • Finalize and distribute GPP. • Approve guidance on including green purchasing in environmental audits and EMS. • Conduct green purchasing training during annual business conference. • Finalize SBIP addressing all 5 guiding principles; Implement actions due. • Finalize Electronics Implementation Plan; Implement planned milestones.	• DOE went from Yellow to Red on Status because it was unable to achieve the Yellow standard for success on the EO 13148 facility metrics. • DOI remains Green on Progress because it completed most of its planned actions for the last 6 months. However, DOI was unable to complete its green purchasing activities due to internal clearance issues. To remain green in progress, DOI will need to finalize its green purchasing plan and guidance by 6/30/07. • Individual Bureaus will be preparing SBIPs in 2007. • Electronics Implementation Plan needs to include aggressive milestones and targets to attain program goals.

[1] Status will be updated annually to reflect performance data collected at the end of each fiscal year. Progress will be assessed twice annually (Jan/July)..
[2] Each agency is required to ask GSA to institute sustainable design in contracts and leases on its behalf.

ENVIRONMENTAL STEWARDSHIP STANDARDS FOR SUCCESS

		
Agency: • Met all EO 13148 EMS agency-level criteria and facility-level criteria at all appropriate facilities. • Has a comprehensive, written green purchasing plan (GPP) that includes recycled content products, Energy Star/energy efficient (EE) products, biobased products, and environmentally preferable products (EPP)[3]; demonstrates compliance in representative acquisitions (e.g., construction, O&M, office supplies, etc.); audits compliance annually; and develops corrective action plans to address shortcomings in GPP preference program. • Demonstrates comprehensive implementation of a sustainability program for green buildings that at a minimum requires sustainability design principles on all new construction and major renovations and is consistent with EPACT 2005 and EO 13123, and/or is implementing the Memorandum of Understanding (MOU) on Federal Leadership in High Performance and Sustainable Buildings (1/24/06) or equivalent. • Demonstrates comprehensive implementation of a sustainability program for electronic stewardship that at a minimum promotes the purchase, operation, and use of end-of-life management strategies for electronic assets consistent with the MOU on Electronics Stewardship (11/15/04), or Federal Electronics Challenge (FEC) or equivalent. • Has a comprehensive Compliance Management Plan (CMP) and an implementation strategy in accordance with the 11/04 President's Management Council (PMC) Compliance Initiative Memorandum.	Agency: • Has met all EO 13148 EMS agency-level criteria, and at least 50 percent of appropriate facilities meet facility-level criteria. • Has a GPP for recycled content, biobased, & environmentally preferable products; includes requirements for these products in representative acquisitions (e.g., construction, O&M, office supplies, etc.). • Has developed a sustainability program for green buildings and/or has signed the MOU on Sustainable Buildings. Implementation beginning but not yet comprehensive across agency. • Signed the MOU on Electronic Stewardship and/or has a plan to meet the objectives of the MOU; and/or is a FEC partner • Has selected initiatives for a Compliance Management Plan and/or developed a strategy with the Federal Environmental Executive in accordance with the PMC Compliance Initiative.	Agency: • If applicable, has not met agency-level criteria or sufficient, appropriate facility-level criteria per the EO 13148 EMS report card. • Has no GPP or only has a GPP for some required products and/or cannot demonstrate inclusion of green products in acquisitions. • Does not have a sustainability program for green buildings or did not sign MOU on Sustainable Buildings. • Did not sign MOU on Electronic Stewardship or does not have a program to promote sustainable environmental stewardship of Federal electronic assets. If applicable, has not selected initiatives for a stand alone CMP or has not discussed a strategy with the Federal Environmental Executive.

Attachment 2
ENERGY MANAGEMENT SCORECARD
DEPARTMENT OF THE INTERIOR

	CURRENT STATUS (As of January 1, 2007)[1]		PROGRESS		COMMENTS
ENERGY MANAGEMENT **Senior Energy Official:** R. Thomas Wiemer **Lead DOE Analyst:** Brad Gustafson **Lead OMB Analysts:** Cyndi Vallina and Rob Sandoli	 Green ↑ from Red	• 2005 reduction in energy intensity in standard buildings compared with 1985: 4.9% (Information only; no impact on score) • Reduction in energy intensity in EPACT goal-subject facilities compared with 2003: **X** 2 percent and on track for 20 percent by 2015 15.1% in 2006 (G) ___ 1 percent ___ (Y) • Use of renewable energy as a percent of facility electricity use: **X** 2.5 percent 14.6% in 2006 (G) ___ 2.0 percent__ (Y) • Metering plan to meter energy use in 100 percent of appropriate facilities by 2012: **X** On track in implementing plan 2006 (G) **X** Plan approved by DOE 2006 (Y) • Percent of new building designs begun in FY 2007 that are 30 percent more energy efficient than relevant code: NA 100 percent _(date)_(G) NA 50 percent _(date)_(Y)	 Green No Change	Actions taken since July 1, 2006: • Submitted final DOI Electric Metering Implementation Plan to DOE and began implementation. • Submitted revisions to DOI FY 2003 Energy Baseline to DOE. • Validated and updated renewable energy registry to determine Bureau on-site renewable energy generation. • Issued memorandum from Deputy Secretary to all employees highlighting the energy management scorecard and stressing continued need to conserve energy at work and home. • Issued memorandum from Deputy Secretary to Bureau Heads highlighting EPACT' 05 energy management requirements and emphasizing importance of making progress toward goals. • Submitted annual report to DOE by 1/1/2007. • Submitted funding request per A-11/Sec25 by 9/06 & update by 1/1/07. Planned actions for next six months: • Develop guidance to Bureaus on annual energy goals and overall status of DOI energy program. • Continue to purchase renewable energy and/or renewable energy certificates. • Initiate Energy Management Program Reviews with Bureaus. • Award Phase 2 of BLM ESPC to audit and implement ECMs including advanced meters. • Develop and submit list of all new building projects starting design phase in FY 2007 subject to EPACT Section 109.	• DOI Status improved from Red to green as DOI met all of the current Green standards for success. DOI Progress remains Green as it completed all planned actions for the last 6 months. • In FY 2006, compared to FY 2003, DOI's reduction in energy intensity was 9.7% without credit for renewable energy purchases; it is a 15.1% reduction with the credits. • DOI Metering Implementation Plan approved and is beginning implementation. • DOI invested $12 million in energy efficiency projects during FY 2006, 12.6% of its facility energy costs. • $1.6 million of this investment was through an ESPC.

[1] Status will be updated once annually (Jan 1) to reflect performance data collected at the end of each fiscal year. Progress will be assessed twice annually (Jan and July). Quantitative standards for success for Yellow and Green will increase each year in accordance with requirements of Executive Order 13123 or the 2005 Energy Policy Act.

January 2007

ENERGY MANAGEMENT STANDARDS FOR SUCCESS

		
Agency: • Has reduced energy intensity (Btu/ GSF) in EPACT goal-subject facilities by 2 percent compared with 2003 and is on track for 20 percent reduction by 2015. • Uses at least 2.5 percent renewable energy as a percentage of facility electricity use. • Has a metering plan approved by OMB and DOE and is on track in implement-ing the plan to meter energy use in 100 percent of appropriate facilities by 2012. • Demonstrates that 100 percent of new building designs beginning October 1, 2006, are 30 percent more efficient than the 2004 International Energy Conservation Code (residential buildings) or the ASHRAE Standard 90.1-2004 (non-residential buildings), if life-cycle cost effective.	Agency: • Has reduced energy intensity (Btu/ GSF) in EPACT goal-subject facilities by 1 percent compared with 2003. • Uses at least 2.0 percent renewable energy to power facilities and equipment. • Has a metering plan approved by OMB and DOE to meter energy use in 100 percent of appropriate facilities by 2012. • Demonstrates that at least 50 percent of new building designs beginning October 1, 2006, are 30 percent more efficient than the 2004 International Energy Conservation Code (residential buildings) or the ASHRAE Standard 90.1-2004 (non-residential buildings), if life-cycle cost effective.	Agency: • Has not yet reduced energy intensity (Btu/GSF) in EPACT goal-subject facilities by 1 percent compared with 2003. • Does not use at least 2.0 percent renewable energy to power facilities and equipment. • Does not have a metering plan approved by OMB and DOE to meter energy use in 100 percent of appropriate facilities by 2012. Plan must have follow DOE guidance and contain action items and milestones. • Cannot demonstrate that at least 50 percent of new building designs beginning October 1, 2006, are 30 percent more efficient than the 2004 International Energy Conservation Code (residential buildings) or the ASHRAE Standard 90.1-2004 (non-residential buildings), if life-cycle cost effective.

ATTACHMENT 3

[BUREAU NAME]
Sustainable Buildings Implementation Plan
[DATE]

ACTION ITEM	INDIVIDUAL RESPONSIBLE	TARGET COMLETION DATE	ACTUAL COMPLETION DATE
PROGRAMMING AND IMPLEMENTATION			
Develop Sustainable Design/Green Buildings Policy and Implementation Plan that: - Defines applicable new buildings, major and minor renovations based on building type, size, and budget. (To be revised annually, as appropriate.) - Complies with OMB Circular A-11 Part 7 Section 300 - Planning, Budgeting, Acquisition, and Management of Capital Assets.		By NLT 12/31/06 (required for OMB Scorecard Green rating)	
Establish agency policy that all new construction or major modifications will include establishing a cross functional team with representation from sustainable design, energy, environment, commissioning, measurement and verification, water efficiency, facilities, building materials, integrated design, ventilation and thermal comfort, moisture control, day lighting, indoor air quality, construction wastes, and other green building qualifications for the design, construction, and commissioning of the project.		By NLT 6/30/07 (expected to be required for OMB Scorecard Green rating)	
Develop an nine-part strategy document that addresses the following action items:		By NLT 6/30/07 (Not expected to be a required OMB submission; rather, this is a recommended approach to meeting agency program goals)	
Part 1 – Perform a "gap analysis" of existing policies, programs, criteria, specifications, and authorities that address sustainable buildings goals and identify shortfalls.			
Part 2 – Establish specific sustainability performance targets for meeting goals in the Guiding Principles.			
Part 3 – Establish definitions and assignment of responsibilities for: 1) functional relationships in the decision-making process; 2) key players; and 3) the chain of command in establishing the commitment for the approval process			
Part 4 – Create template agreements to be used by building property officials and senior management to demonstrate commitment to the Guiding Principles.			
Part 5 – Establish procedures for measuring compliance			

ACTION ITEM	INDIVIDUAL RESPONSIBLE	TARGET COMLETION DATE	ACTUAL COMPLETION DATE
with established mandates, goals, targets, and score cards.			
Part 6 – Create a strategy for addressing sustainable buildings in capital planning and budgeting per OMB Circular A-11 Part 7 Section 300 - Planning, Budgeting, Acquisition, and Management of Capital Assets			
Part 7 – Describe how the Sustainable Buildings Program is being coordinated with the EMS and/or asset management plan.			
Part 8 – Create a strategy for promotion of the plan to the field by education and training			
Part 9 – Create a strategy for communication of the plan to the authority with jurisdiction to incorporate plan/goals into their services			
Modify all pertinent agency policies to incorporate *Guiding Principles.*		By NLT 12/31/07 (expected to be required for OMB Scorecard Green rating)	
Establish a procedure to incorporate the *Guiding Principles* into criteria, specifications, and contract language for new construction and major renovations and ultimately into existing building operation and maintenance *(Note: consider utilizing the WBDG Federal Green Construction Guides for Specifiers)*		By NLT 12/31/07 (Not expected to be a required OMB submission; rather, this is a recommended approach to meeting agency program goals)	
Develop a strategy to address sustainability opportunities for those buildings agencies determined "Not applicable" to all of the 5 *Guiding Principles*.		By NLT 12/31/07 (Not expected to be a required OMB submission; rather, this is a recommended approach to meeting agency program goals)	
Correct other shortfalls identified in the gap analysis (Strategy Document Part 1).		By NLT 12/31/07 (Not expected to be a required OMB submission; rather, this is a recommended approach to meeting agency program goals)	

ACTION ITEM	INDIVIDUAL RESPONSIBLE	TARGET COMLETION DATE	ACTUAL COMPLETION DATE
AGENCY TRACKING & REPORTING			
Define the unit of measurement for tracking/reporting agency progress (# of certified buildings, etc.)		By NLT 12/31/07 (Not expected to be a required OMB submission; rather, this is a recommended approach to meeting agency program goals)	
Establish a procedures to identify and track new construction and major renovation projects and determine if the *Guiding Principles* were incorporated into criteria, specifications, and contract language and ultimately into existing building operation and maintenance.		By NLT 12/31/07 (Not expected to be a required OMB submission; rather, this is a recommended approach to meeting agency program goals)	
Develop semi-annual system for reporting agency progress towards addressing the *Guiding Principles* in all building life cycle stages: • Siting • Design • Construction • Operations & maintenance • End of life		By NLT 6/30/07 (Not expected to be a required OMB submission; rather, this is a recommended approach to meeting agency program goals)	
Begin semi-annual reporting of Agency progress toward meeting the *Guiding Principles* in all building life cycle stages: • Siting • Design • Construction • Operations & maintenance • End of life		By NLT 6/30/07 (expected to be required for OMB Scorecard Green rating)	
Identify and prioritize existing facilities for a continuous commissioning strategy, which addresses key environmental aspects, including energy use and IEQ. Ensure the strategy is developed and signed by senior officials.		By NLT 6/30/08 (expected to be required for OMB Scorecard Green rating)	
Establish a process to track and report existing facilities continuous commissioning strategy success.		By NLT 6/30/08 (Not expected	

ACTION ITEM	INDIVIDUAL RESPONSIBLE	TARGET COMLETION DATE	ACTUAL COMPLETION DATE
		to be a required OMB submission; rather, this is a recommended approach to meeting agency program goals)	
Institute measurement, verification, and training to ensure continual improvement. Continuous commissioning should extend to training of operations and management staff.		By NLT 6/30/09 (expected to be required for OMB Scorecard Green rating)	
Report into High Performance Buildings database		By NLT 6/30/07 (expected to be required for OMB Scorecard Green rating)	

(By NLT 12/31/06: required for OMB Scorecard Green rating)

(Signature of Environmental Executive (EE))
(Title/Office)

Signature of Energy Executive (EE))
(Title/Office)

Signature of Real Property Executive (RPE))
(Title/Office)

Signature of Facilities and Maintenance (FME))
(Title/Office)

Signature of Chief Acquisition Officer (CAO))
(Title/Office)

Signature of Chief Financial Officer(CFO))
(Title/Office)

APPENDIX A

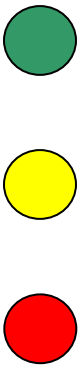
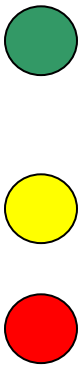
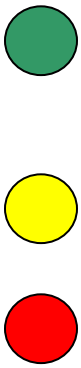
GUIDANCE FOR MEASURING SUSTAINABLE BUILDING SUCCESS ON THE OMB ENVIRONMENTAL MANAGEMENT SCORECARD

The OMB Environmental Management Scorecard was developed to measure agency performance in meeting the requirements of the Greening the Government Executive Orders and the 2005 Energy Policy Act

The phased-in approach to standards of success outlined below recognizes that sustainable design/green buildings is a relatively new issue without the structure and mandates of other environmental initiatives. Participating Agencies estimated the need for a multiyear timeline for program development and implementation that will be addressed in more detail once the MOU begins to be fully implemented in its first year.

Agencies recommended that OMB and OFEE establish annual interim "standards for success" that will phase-in requirements and allow Agencies to be recognized for their progress towards future established goals.

Year	**Standard for Success**
2006	•Issue Sustainable Design/Green Buildings Policy and Implementation Plan that: -Defines applicable new buildings, major and minor renovations based on building type, size, and/or budget. -Complies with OMB Circular A-11 Part 7 Section 300 - Planning, Budgeting, Acquisition, and Management of Capital Assets. • Signed Policy and Implementation Plan in development. • Nothing done.
2007	• Key programmatic framework activities are implemented including: policies, responsibilities, tracking, measurement, and funding. • Agency employs integrated design teams for all 'new start' capital asset projects involving new buildings and/or major renovations in order to address the *Guiding Principles.* • The success stories and lessons learned for at least one major building project are reported into the High Performance Buildings Database. • Meets the GREEN scoring requirement for the previous year • Doesn't meet YELLOW

2008 	Meets the GREEN scoring requirement for the previous year and: • All applicable 'new start' capital asset projects involving new buildings and/or major renovations meet the *Guiding Principles*, except where written justification is provided • In order to apply *Guiding Principles* to existing buildings, a Continuous Commissioning Strategy, which prioritizes facilities and addresses key environmental aspects, including energy use and IEQ, is developed and signed by senior officials. • Meets the GREEN scoring requirement for the previous year • Doesn't meet YELLOW
2009 	Meets the GREEN scoring requirement for the previous year and: • Continuous commissioning strategy implemented and at least 15 percent of priority existing facilities have undergone whole building commissioning. • Meets the GREEN scoring requirement for the previous year • Doesn't meet YELLOW
2010 	Meets the GREEN scoring requirement for the previous year plus: • Continuous commissioning strategy implemented and at least 30 percent of priority existing facilities have undergone whole building commissioning. • Meets the GREEN scoring requirement for the previous year • Doesn't meet YELLOW

APPENDIX B

GUIDING PRINCIPLES FOR FEDERAL LEADERSHIP IN HIGH PERFORMANCE AND SUSTAINABLE BUILDINGS MEMORANDUM OF UNDERSTANDING (MOU)

I. EMPLOY INTEGRATED DESIGN

1) Performance goals for siting, energy, water, materials, indoor environmental quality, and comprehensive design.
2) Total building commissioning practices tailored to the size and complexity of the building and system components.
3) Verify performance of building components
    a. Designated commissioning authority
    b. Inclusion of commissioning requirements in construction documents
    c. Commissioning plan
    d. Verification of installation and performance systems
    e. Commissioning report

II. OPTIMIZE ENERGY PERFORMANCE

1) Establish a whole building performance target for intended use, occupancy, operations, plug loads, and other energy demands
2) Design to earn Energy Star® targets for new construction and renovation where applicable
3) Reduce the energy cost budget by 30 percent compared to the baseline building performance rating per the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., (ASHRAE) and the Illuminating Engineering Society of North America (IESNA) Standard 90.1-2004, Energy Standard for Buildings except Low-Rise Residential for new construction.
4) Reduce the energy cost budget by 20 percent below pre-renovations 2003 baseline for major renovations.
5) Install building level utility meters in new major construction and renovation projects to track and continuously optimize performance (In accordance with DOE guidelines issued under section 103 of the Energy Policy Act of 2005 (EPAct))
6) Compare actual performance data from the first year of operation with the energy design target.
7) Measure all new major installations using the Energy Star® Benchmarking Tool for building space types covered by Energy Star® after one year of occupancy.
8) Enter data and lessons learned from sustainable buildings into the High Performance Buildings Database (www.eere.energy.gov/femp/highperformance/index.cfm)

III. PROTECT AND CONSERVE WATER

1) Employ strategies that in aggregate use a minimum of 20 percent less potable water than indoor water use baseline calculated for the building, after meeting the Energy Policy Act of 1992 fixture performance requirements.
2) Reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means by using water efficient landscape and irrigation strategies including water reuse and recycling.
3) Employ design and construction strategies that reduce storm water runoff and polluted site water runoff.

IV. ENHANCE INDOOR ENVIRONMENTAL QUALITY

1) Meet current ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone
2) Meet ASHRAE Standard 62.1-2004 Ventilation for Acceptable Indoor Air Quality.
3) Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage and mold contamination.
4) Achieve a minimum of daylight factor of 2 percent (excluding all direct sunlight penetration) in 75 percent of all space occupied for critical visual tasks.
5) Provide automatic dimming controls or accessible manual lighting controls, and appropriate glare control.
6) Specify materials and products with low pollutant emissions, including adhesives, sealants, paints, carpet systems, and furnishings.
7) Follow recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction (1995).
8) Conduct a minimum 72 hour flush out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent after construction and prior to occupancy.
9) Continue flush-out as necessary to minimize exposure to contaminants from new building materials after occupancy.

V. REDUCE ENVIRONMENTAL IMPACT OF MATERIALS

1) Use products meeting or exceeding EPA's recycled content recommendations for EPA-designated products.
2) Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project.
3) Use products meeting or exceeding USDA's biobased content recommendations for USDA-designated products.
4) Use biobased products made from rapidly renewable resources and certified sustainable wood products for other products.
5) Identify local recycling and salvage operations that could process site related waste during a project's planning stage.
6) Program the design to recycle or salvage at least 50 percent construction, demolition, and land clearing waste, excluding soil, where markets or on-site recycling opportunities exist.
7) Eliminate the use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI or the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account life cycle impacts.

ATTACHMENT 4

TECHNICAL GUIDANCE

I. OPTIMIZE ENERGY PERFORMANCE

The optimization of energy performance can be applied in many ways. The introduction of daylight into interior spaces through careful placement of large, high windows and clerestory windows for balanced light is an excellent way to apply to every new facility. In appropriate settings, use thick, massive walls such as masonry, earth walls, and straw bales designed at the correct thermal mass to retain and release heat. The insulation of roofs to maintain desired interior temperature is an excellent way to conserve energy. The location of mechanical systems centrally for efficient distribution of heat, cooling, and power will decrease energy consumption. In mild climates, consider using operable windows and other measures to reduce the need for mechanical ventilation. Consider ground-coupled heat pumps, passive solar, and other energy-saving heating techniques when planning new facilities.

Samples of areas that can be considered in the area of Energy Conservation include:

Passive Solar Design
Earth Shelter Design
Photovoltaic
Duct Design
Energy Recovery
GeoExchange Systems
Energy Efficient Lighting
LED Exit Signs
Radiant Barriers
Solar Systems
Gas Water Heating and Air Conditioning
Fan Usage
Ventilator Appliances
Direct Digital Controls for HVAC Systems
Occupancy Sensors

A. Passive Solar Design

Passive solar design refers to the use of the sun's energy for the heating and cooling of living spaces. In this approach, the building itself or some element of it takes advantage of natural energy characteristics in materials and air created by exposure to the sun. Passive systems are simple, have few moving parts, and require minimal maintenance and require no mechanical systems.

Operable windows, thermal mass, and thermal chimneys are common elements found in passive design. Operable windows are simply windows that can be opened. Thermal mass refers to materials such as masonry and water that can store heat energy for extended time. Thermal mass will prevent rapid temperature fluctuations. Thermal chimneys create or reinforce the effect of hot air rising to induce air movement for cooling purposes.

Wing walls are vertical exterior wall partitions placed perpendicular to adjoining windows to enhance ventilation through windows.

Passive design is practiced throughout the world and has been shown to produce buildings with low energy costs, reduced maintenance, and superior comfort. Most of the literature pertaining to passive solar technology addresses heating concerns. Key aspects

of passive design include appropriate solar orientation, the use of thermal mass, and appropriate ventilation and window placement.

A basic passive cooling strategy is to permit cooler night air to ventilate a facility and cool down the thermal mass (this can be brick, stone, or concrete walls or floors, or large water containers) inside the building. The thermal mass will absorb heat during the day; however, excessive humidity will reduce the cooling effect from the cooler thermal mass. Interior design elements of a building also play a strong role in the effectiveness of passive cooling. For example, carpets, drapes, and fabric-covered furniture will absorb moisture from humid air, forcing the air conditioner to work harder to remove humidity.

As a design approach, passive solar design can take many forms. It can be integrated to greater or lesser degrees in a building. Key considerations regarding passive design are determined by the characteristics of the building site. The most effective designs are based on specific understanding of a building site's wind patterns, terrain, vegetation, solar exposure and other factors often requiring professional architectural services. However, a basic understanding of these issues can have a significant effect on the energy performance of a building.

B. Radiant Barriers

A radiant barrier is a layer of metallic foil that blocks radiated heat, assisting in the energy performance of a building.

A ridge-and-soffit venting system is a continuous, weather-shielded opening at the peak of the roof in combination with continuous screened openings along the eaves of the building. This system provides air movement under the roof that washes the underside of the roof with air that is exhausted out the top of the roof through the ridge vent.

A radiant barrier is used principally as a cooling strategy. Buildings gain heat in three ways – conduction, convection, and radiation. A radiant barrier is useful in preventing heat gain from radiation.

Emissivity is an indication of a surface's ability to emit heat by radiation. The lower the emissivity, the better the radiant barrier qualities of a material. Emissivity is measured on a scale of zero to one. Most foil type radiant barriers have an emissivity of 0.05 or below, which means 95% of the radiant heat is being blocked.

A radiant barrier is typically placed beneath roofs to block the heat gain radiating from hot roofs. Temperature reductions of 10 degrees or more are typical during peak summer days. The reduction of attic temperatures is considered less important in highly insulated attics (R-30 and higher), in respect to conduction through the ceiling. If air conditioning ductwork is located in the attic, lowering the attic temperature reduces heat gain on the ductwork.

A continuous ridge-and-soffit vent system is the most effective means to ventilate an attic. It is a passive system (no fans) and can outperform fans. The effect of pulling air from the eaves and out at the ridge is an example of the thermal chimney effect (discussed in the "Passive Solar Design" section).

C. Earth Shelter Design

Earth-sheltered design employs the earth as a major component of a building's thermal control system.

Using the earth as a component of the energy system, or "earth-tempering," can be accomplished through three primary methods: direct, indirect, and isolated. In the direct system, the building envelope is in contact with the earth, and conduction through the building elements (primarily walls and floor) regulates the interior temperature. In the indirect system, the building interior is conditioned by air brought through the earth, such as in earth tubes. The isolated system uses earth temperatures to increase the efficiency of a heat pump by moderating temperatures at the condensing coil. A geothermal heat pump is an example of an isolated system. This discussion will focus on direct and indirect systems.

High humidity levels may create mood problems in direct and indirect earth sheltered systems. Good ventilation and dehumidification can reduce these problems in direct systems. High temperatures and low ground moisture in the summer (moist soil conditions are preferable for best conductivity) must also be addressed for optimal benefits from earth sheltering.

In the winter, passive solar features can maintain comfort levels by warming the thermal mass. (Earth-sheltered facilities are typically built with concrete, which has high-thermal mass.)

Costs for a building incorporating direct earth-sheltering can run about 10% higher than conventional building. Some manufactured systems are closer to conventional building costs. Lower maintenance and operating costs are typical for earth-sheltered buildings.

D. Solar Systems

The solar systems that will be discussed in this section are not a part of a building's structure. The function of the solar energy equipment is to convert sunlight to heat that can be used for: (a) space heating; (b) space cooling; (c) domestic hot water.

Solar systems should be employed only after extensive conservation strategies have been implemented. Solar energy systems typically have a high initial cost and extremely low operating costs. To reduce the high initial costs, reduce the size of the required system by the load that the solar system will need to provide. In space heating and cooling applications, the facility should be weatherized and insulated to very high standards. In

water heating applications, hot water piping should be insulated and water conserving fixtures should be used.

The goal of the solar system should not be to accomplish 100% of the building's heating, cooling, or water heating needs under all conditions. The system should be sized to reflect seasonal variations in demand and in the sun's heating characteristics. Additionally, by combining systems to perform multiple functions (i.e. space heating and water heating), the solar system investment can provide a return all year.

There are several types of solar systems in each of the categories of space heating, water heating, and space cooling. Of the three general categories, space cooling by solar energy is the least cost effective except in passive applications, which are discussed in the Passive Solar Design section.

E. Photovoltaic

The word "photovoltaic" combines two terms – "photo" means light and "voltaic" means voltage. A photovoltaic system in this discussion uses photovoltaic cells to directly convert sunlight into electricity.

The technology employed in photovoltaic (PV) systems is well-developed and there are improvements and modifications occurring regularly, primarily in production processes. The systems are quite reliable and have been well tested in space and terrestrial applications.

The primary obstacle to increased use of photovoltaic systems is their high initial cost. Continuous price reductions have been occurring. In some off-grid locations as short as one quarter mile, photovoltaic systems can be cost effective versus the costs of running power lines into the property and the subsequent continual electric charges.

Electric power generation options are now starting to be compared on a basis that includes "externalities." Externalities are the "hidden" costs associated with a power source that are not accounted for in the price of the power produced. These hidden costs include damage to the environment caused by the sourcing, processing, transporting, using, and disposal aspects of a power source. The operational costs and externalities associated with the conventional fuel mix (coal, oil, nuclear, natural gas) used for generating electricity are not substantially less than the "full" costs associated with photovoltaic systems and, in many cases, exceed the costs of PV's. The use of PV's is much less polluting than other fuel choices.

The primary strategy for use of PV's as the electrical power source for a building is reducing the need for electricity. Refrigerators, air conditioners, electric water heaters, electric ranges, electric dryers, and computers are all large users of electricity. Highly energy conserving alternatives and gas appliances are available to greatly reduce electrical loads.

F. Gas Water Heating and Air Conditioning

Gas water heating for domestic hot water can be engineered to provide space heating as well as water heating. Known as a combination (or combo) system, a single appliance can perform two functions.

There are several positive features to a combination water heating/space heating (combo) system. Several high efficiency models are available that allow venting of the water heaters through a wall instead of a chimney. Electric heating is not involved permitting a reduced electric panel size. Less space is needed compared to two separate systems. The air handler can be located to minimize ductwork.

The combo system circulates hot water from the water heater through a heat exchanger in the air handler. A blower will move the heated air through a standard duct system. In the summer, an air conditioner is connected to the exchanger and the system functions similarly, with cool air being pushed through the ductwork.

The use of gas water heaters is generally considered a positive (although not perfect) environmentally-based choice. The pollutant levels created by natural gas combustion are less than other conventional water heating options except solar. The system selected should be Energy Star rated and have a guaranteed savings indicated from the manufacturer.

G. Duct Design

A high quality duct system greatly minimizes energy loss from ductwork. Leaks in ductwork can contribute 20 to 60 percent of the air leakage in a building. The system should be airtight, sized and designed to deliver the correct air flow to each room. MADAIR (Mechanical Air Distribution and Interacting Relationships) refers to the principles underlying duct installations.

Duct leakage is a major source of energy loss in facilities and a contributor to poor indoor air quality. Good system design, improved duct and sealing materials combined with proper installation reduce energy losses. Some design strategies are simple, such as allowing adequate airspace under interior doors to permit air to return to plenums outside of the room.

Depressurization and over pressurization can occur in buildings due to faulty duct system characteristics. As a result, air is exchanged (through infiltration and exfiltration) with outside air and hotter attic air.

Depressurization can be caused by closing interior doors, blocking air that is supplied to rooms from reaching the return air plenum (usually located in a central area of the building). The return air plenum will consequently be starved for air and pull air from wherever it can. This can include the flue from a gas water heater, which is why some water heaters show signs of flame “rollout” (burn marks on the outside of a gas water

heater). In the same scenario, the rooms receiving air from the system are over pressurized. The air can exfiltrate (migrate outdoors) and cause energy losses or enter wall cavities possibly introducing moisture problems.

Poorly sealed duct connections permit attic air to enter the system in cases of depressurization or become energy losses as system air is lost into the attic. Proper techniques, materials, and training to address these problems are available. A growing number of regulatory and energy conservation agencies throughout the nation are actively seeking to eliminate poor ductwork systems as a serious health, safety, and energy issue.

H. Fan Usage

The traditional method for creating comfort in hot/humid climates is through air movement. The modern building can use this traditional method readily with ceiling fans to move air in individual rooms, and whole building fans to pull in cooler outside air. Using Variable Frequency fans is recommended.

Moving air with ceiling fans allows building occupants to feel comfortable at higher temperatures. As a result, mechanical cooling equipment temperature settings can be higher and an energy savings greater than the energy consumption of the fans can be realized. According to the Texas Energy Extension Service, for a 3 ton cooling system costing $550 per season, raising the thermostat from 75 degrees to 80 degrees can reduce the operating cost $151. Operating a ceiling fan 10 hours a day or more can cost less than $3 per month.

In the heating season, ceiling fans can help bring the warmer air that stratifies near the ceiling down to where the occupants are located. A low speed that does not create significant breeze is best for this heating season application. The most useful ceiling fans will have variable speed settings.

A whole building fan offers energy savings and comfort when operated in conjunction with or without mechanical cooling. The performance of a whole building fan in hot/humid climates is optimized when used in facilities with high mass interiors and reduced moisture adsorbing materials (i.e. carpeting).

I. Energy Recovery Ventilator

An energy recovery ventilator (ERV) is a type of mechanical equipment that features a heat exchanger combined with a ventilation system for providing controlled ventilation into a building.

An energy recovery ventilator with humidity regulation incorporates a method to remove excess humidity or add humidity to the ventilating air that is being brought into a building.

This type of equipment was introduced as “air-to-air” heat exchangers in the colder regions of the U.S., Canada, Europe, and Scandinavia over 10 years ago. In these areas, tightly-built modern buildings were developing problems with indoor air quality and excessive humidity during the winter. The air-to-air heat exchanger brought in fresh outside air to combat these problems, and preheated it at the same time. These products are now called heat recovery ventilators or HRVs.

If a building is constructed tighter than 0.5 air changes per hour, any pollutants generated in the building can accumulate and reduce the indoor air quality to unhealthful levels. If fresh outside air is brought in through an open window to alleviate this problem, this air may be excessively hot, cold or humidity-laden and require conditioning at added expense.

In some regions, cooling energy costs can exceed heating energy costs. Therefore, it is more appropriate to consider this equipment useful in recovering “energy” (energy recovery ventilator) not simply “heat” (heat recovery ventilator).

J. Appliances

The primary appliances that will be discussed are refrigerators, dishwashers, computers and clothes washers. Water heaters are discussed in the Gas Water Heater/Combination Heater Section. Dishwashers are often provided by builders in new facilities; refrigerators and washers are usually supplied by the owners.

There can be a significant difference in the energy consumption of appliances. Energy Guide labels are present on all major appliances to help select the most efficient models. These labels compare the model bearing the label with other similar models. However, this information does not indicate whether one has selected the most efficient appliance. The most efficient appliance will have certain features that should guide the purchaser to selecting the most efficient model with those features.

An example is clothes washers that are top loading vertical axis machines are not as efficient as clothes washers that are front loaders with a horizontal axis – both in energy and water use. The improvement by using a front loader can exceed 50% in both energy and water use. Start by identifying the features (in this case, horizontal axis design) that create the most efficient energy consumption of an appliance as a starting point.

Refrigerators similarly have different efficiencies according to features such as defrosting characteristics (manual, partial automatic, automatic), door style, and size. The top freezer models outperform the side by side models and partial automatic or manual defrost models are the most efficient.

Many dishwashers offer special features that improve energy efficiency. Booster heaters and no-heat drying are two helpful features. It is also important to know how much water is required by the different models and select those that can accomplish the cleaning with the least amount of water.

K. GeoExchange Systems

A geoexchange system is an electrically powered heating and cooling system for interior spaces. This system utilizes the earth (or a pond or lake) for both a heat source and a heat sink. Components of this system include a heat pump, a hydronic pump, a ground heat exchanger, and a distribution subsystem. Most geoexchange systems utilize air ducting for the distribution system, and polyethylene piping in the earth for the heat exchanger.

A heat pump is an electrically powered mechanical device that takes heat from one location and moves it to another location. A typical air conditioner is a form of a heat pump in that it takes heat out of the interior space and then rejects that heat outdoors. However, a true heat pump can work in either direction, unlike a typical air conditioner. A heat pump can take heat out of an interior space, or it can put heat into an interior space.

Unlike the air conditioner that rejects heat into the surrounding air through the condenser (which resembles a caged box, sits outside the facility , and makes noise when it turns on), the geoexchange heat pump rejects heat into the earth during the cooling mode, and takes heat out of the earth while in the heating mode. GeoExchange Heat Pumps are more commonly referred to as Ground Source Heat Pumps.

GeoExchange systems, like common heat pumps and air conditioners, make use of a refrigerant to help transfer (or pump) heat into and out of your facility. The refrigerant helps the GeoExchange system take advantage of two primary principles of heat transfer:

1. Heat energy always flows from areas of higher temperature to areas of lower temperature.
2. The greater the difference in temperature between two adjacent areas, the higher the rate of heat transfer between them.

Refrigerators, air conditioners, and heat pumps all operate by pumping refrigerant through a closed loop in a way that creates two distinct temperature zones–a cold zone and a hot zone.

The simplest example of such a system is the universally familiar home refrigerator. In a refrigerator, a fan blows the air inside the box over tubes containing refrigerant that is very cold (typically below 0° F). Heat flows from the interior air to the cooler refrigerant. The refrigerant is then pumped to the high-temperature section, which is exposed to room air outside the refrigerator box. Because the refrigerant is hot in this zone, it gives up heat to the relatively cooler air in the room, before flowing back to the cold zone to begin the loop again.

An air conditioner works in exactly the same way, except that it extracts heat from the air inside a room or building and transfers it to the air outside the building.

A conventional heat pump adds a reversing capability, so the hot zone and the cold zone can be switched. With the zones reversed, it can extract heat from the outside air in the winter and transfer it inside.

Granted, being able to extract heat from frigid winter air seems like it shouldn't work, but it will if we can expose the cold air to refrigerant that's even colder than it is. And modern heat pumps can do that.

When the outside air gets extremely cold, the conventional (air source) heat pump has to resort to electric resistance heating. This reduces efficiency dramatically.

Standard (air source) heat pumps, while relatively simple to operate, face one major challenge: their operating efficiency is lowest when demand is highest. That is, heat pumps (air source) have to work hardest when we demand the most performance from them.

As we've just seen, a regular heat pump (air source) extracts heat energy from outside air in the winter, and rejects heat to outside air in summer. Unfortunately, the colder the outside air, the more difficult it is to extract heat from it, and the hotter the outside air, the harder it is to transfer heat to it. The temperature difference between the air and the refrigerant is small in both cases, lowering heat transfer rates within the system.

Yet, the colder it gets outside, the higher the rate of heat loss through windows, around doors, and through walls and roofs, and the more heat we need to pump inside to keep indoor temperatures comfortable. In summer, we face a similar dilemma. The hotter it gets outside, the higher the rate of heat infiltration into the facility , and the more heat removal we need to maintain comfort.

A GeoExchange system eliminates this dilemma by using the relatively constant temperature of the earth as a heat source in winter and a heat sink in summer, instead of outside air.

Throughout most of the U.S., the temperature of the ground below the frost line (about 3 to 5 feet below the surface) remains at a nearly constant temperature, generally in the 45 ° -50 ° F range in northern latitudes, and in the 50 ° -70 ° F range in the south. So, in the winter, a GeoExchange unit can extract heat from the earth that's relatively warm compared to the cold outside air, and in the summer, it can discharge heat to the earth that is relatively cool, compared to the hot outside air. Since the difference between the refrigerant temperature and the ground temperature remains relatively high in both seasons, so do heat transfer rates. Consequently, the GeoExchange system operates at much higher year-round efficiencies than a standard heat pump.

Installing a GeoExchange system is environmentally responsible. Since a GeoExchange system merely transfers heat from the ground into your facility in winter, you don't need to burn any fossil fuels to create a warm interior environment. The approach drastically reduces carbon dioxide emissions (a greenhouse gas) compared with the operation of

other heating systems, and completely eliminates the heating system as a potential source of carbon monoxide fumes within your facility – making the GeoExchange system an environmentally friendly as well as safe and healthy alternative to traditional oil and gas furnaces.

The unique aspect of the GeoExchange system, and the key to its lengthy list of benefits, is the "ground loop." The ground loop provides the means of transferring heat to the earth in summer, and extracting heat from the earth in winter. There are "closed loop" and "open loop" systems. First, let's look at typical closed loop systems that recycle the same water (the refridgerant) endlessly.

Physically, the ground loop consists of several lengths of plastic pipe typically installed either in horizontal trenches or vertical holes that are subsequently covered with earth and landscaping of your choice. Water inside the ground loop piping is pumped through a heat exchanger in the GeoExchange unit. In the summer, it absorbs heat from the refrigerant hot zone and carries it to the ground through the ground loop piping. In winter, it absorbs heat from the earth through the ground loop, and then transfers that heat to the refrigerant cold zone.

The length of the ground loop will be determined by the heating and cooling loads, which are determined in turn by the size of your facility, its design and construction, its orientation, and the climate where you live. Whether the ground loop is most efficiently installed in horizontal trenches or in vertical boreholes depends on the type of soil near the surface (rocky, sandy, clay-laden, etc.), the geology of the deeper terrain in your area, and the amount of land available. Generally, horizontal loops are less expensive to install, but require more land area. Vertical holes require much less land area, but require the expense of drilling.

Another ground connection scheme – an "open loop" system – involves using wells instead of closed loop piping. Where water is plentiful, it can be pumped out of a well, through the heat exchanger at the GeoExchange unit, and then pumped back into another well to return to the groundwater. Since the water merely absorbs or gives up heat, but is not altered in any other way, it leaves the GeoExchange unit as pure as it was when it entered it.

Any one of these installation schemes results in the same high efficiency, when properly sized.

Moreover, once the ground loop is installed, you can typically forget about it. The polyethylene piping (the same type used for cross-country natural gas lines) does not degrade, corrode, or break down in ground or water contact, so sound installations are expected to last 50 years or more.

As a side benefit, most GeoExchange systems can be designed to produce free hot water during the summer, by using waste heat extracted from the interior air during the air

conditioning season. Even in the winter, waste heat from the GeoExchange heat pump can be converted to hot water to reduce the energy costs of the hot water heater.

GeoExchange is the most energy-efficient, environmentally clean, and cost-effective space conditioning system available, according to the Environmental Protection Agency. The EPA confirmed the superior efficiency of GeoExchange, finding that even on a source fuel basis – accounting for all losses in the fuel cycle including electricity generation at power plants – GeoExchange systems average 40% greater efficiency than air source heat pumps, 48% greater efficiency than gas furnaces, and 75% higher efficiency than oil furnaces. Today's best GeoExchange systems outperform the best gas technology, gas heat pumps, by an average of 36% in the heating cycle and 43% in the cooling cycle.

GeoExchange systems use the Earth's energy storage capability to heat and cool buildings, and to provide hot water. The earth is a huge energy storage device that absorbs 47% of the sun's energy – more than 500 times more energy than mankind needs every year – in the form of clean, renewable energy. GeoExchange systems take this heat during the heating season at an efficiency approaching or exceeding 400%, and return it during the cooling season.

In addition to operating cost benefits, GeoExchange provides:

1. Heating without combustion of fossil fuels
2. No carbon monoxide or carbon dioxide
3. Increased safety
4. Simpler design, maintenance, and operation
5. Free hot water in the summer
6. No unsightly/noisy air conditioning or air source heat pumps in the yard

L. Direct Digital Controls for HVAC Systems

Digital control systems can economize heating and air conditioning systems to operate at the most efficient levels for cost savings. The systems will pay for its self in the cost savings achieved through its use.

M. Energy Efficient Lighting

The use of T8 and T5 "green" low mercury fluorescent lighting with electronic ballasts or compact fluorescents will substantially decrease operation electrical costs for your facility. These energy efficient and environmental friendly lights are preferred in working areas.

N. Occupancy Sensors

Occupancy sensors control the lighting in each room. The sensors will automatically turn off lights in rooms that are not being used or are unoccupied. The results are energy savings over standard light switches.

O. LED Exit Signs

LED Exit signs have a life of 50 years with little to no maintenance. The energy savings is substantial. The energy use for a typical LED is less than 2 watts and the average exit sign with LED is 15 watts.

II. PROTECT AND CONSERVE WATER

The consideration of constructed wetlands, sand filters, and other alternatives to mechanical systems for sewage treatment will help protect and conserve water. The installation of water-conserving fixtures will conserve water. The exterior conservation of water through such strategies as water harvesting with cisterns, xeriscaping, and graywater recycling will decrease runoff. The Installation of porous paving to minimize erosion and "recharge" the groundwater will help protect the environment.

Included below are areas of consideration in the area of Water Conservation:

Water Pervious Materials
Waterless Urinals
Indoor Water Conservation
Xeriscape Design
Greywater Use
Harvested Rainwater

A. Water Pervious Materials

Water-pervious materials such as gravel, crushed stone, open paving blocks or pervious paving blocks for driveways, parking areas, walkways, and patios minimize runoff from those areas, as well as increase infiltration. Some pervious paving options can retain turf and carry autos and trucks evenly without creating tracks or other heavy traffic wear signs. Many pervious surfaces that receive auto traffic require a clay-type roadbase subgrade. The roadbase material could slow water percolation in heavy rains and cause over-saturation above it, leading to puddles or runoff. It is best to select a pervious paving material that can use the most porous subbase. Care should be taken during installation to minimize excessive soil compaction.

A turf covered pervious surface can be problematic for certain types of footwear, and can stay wetter after rains due to the height of the grass. A compromise approach is to retain a

small impervious walkway to accommodate the areas that provide access to vehicle loading and unloading.

Pervious materials will cost more than asphalt surfaces with some systems costing as much as 40% more. If used in areas with underground utilities needing repair, pervious paving materials can easily be removed from only the repair area. Pavement replacement is simplified and expensive measures such as asphalt cutting are eliminated.

B. Waterless Urinals

A waterless urinal toilet uses no water and eliminates water and sewer costs from urinals. The average urinal will save 1-2 gallons each time it is used. A substantial savings in water costs will be achieved and water usage will be down considerably.

C. Indoor Water Conservation

Indoor water conservation products that meet and exceed code requirements are readily available locally and by mail order. Some studies have indicated that there is not a direct relationship between the price of a water conserving fixture and its ability to provide good service. Therefore, do not use price as a benchmark for quality or performance.

It is important to choose quality products that have standardized replaceable components for best long-term performance. New products are being introduced continuously and it is advisable to review independent research such as Consumer Reports for updates on the performance of the new products.

Indoor water use can be impacted significantly through water appliance selection. Different models of laundry washing machines and dishwashers vary greatly in the quantity of water needed. It is recommended to use horizontal-axis washing machines and water conserving dishwashers.

Devices that divert and capture water that is normally lost waiting for hot water can be useful if long pipe runs from water heaters are present. However, it is best to minimize such long pipe runs through careful planning in the plumbing layout. This saves materials and cost as well as water.

Personal water use habits ultimately influence the effectiveness of water conserving fixtures and appliances.

D. Xeriscape Design

Xeriscape landscapes are defined as “quality landscaping that conserves water and protects the environment.” There are seven principles associated with Xeriscape landscapes:

- Planning and Design – This is the first and most important step in Xeriscape landscaping. The Xeriscape landscape takes into account the regional and microclimatic conditions of the site, existing vegetation and topographical conditions, the intended use and desires of the owner, and the zoning of plant materials according to their water needs. The landscape plan should allow the landscaping to be phased in, with initial phase installation and a future phasing plan as part of the building package. Such a feature can be important in speculative facility construction, and gives added value.

- Soil Improvement – The proper preparation and chemically balance soil for proper plant health and growth.

- Appropriate Plant Selection – Most Xeriscape plants will need no supplemental watering after an establishment period, unless there is an extreme drought. The establishment period after installation may require from 18 to 24 months.

  Almost any plant can be used in a Xeriscape landscape if grouped according to its water needs. Annual and exotic plantings can be located in small, easily accessible areas to make maintenance easier. Irrigation can then be zoned according to plant water needs to make efficient irrigation possible.

  Many native plants have protection mechanisms that cause them to go dormant during periods of stress. They may appear brown, but will turn green again when temperatures improve and it rains.

- Practical Turf Areas – Practical turf areas mean turf areas whose size is suited to the intended use. Huge lawns of exotic grasses will require more maintenance and care than any other type of landscape plant. Lawns may be needed as children's play areas, for pets, sports, or simply for the aesthetic appeal of turf which some people prefer. The maintenance needs of turf can be minimized by the shape of the area, the irrigation equipment used, and the turf type selected.

- Efficient Irrigation – The type of watering equipment best suited to the job depends on the landscape, design, layout and budget. The irrigation design should be integrated with the design of the landscape. A simple garden hose and sprinkler with a few soaker hoses thrown in may be the best way to water some landscapes. Drip or underground systems may be more appropriate for other landscapes or clients.

It is important to note that a newly installed landscape will require more water during an establishment period of one to two years. After this time, a Xeriscape landscape may require no irrigation unless it is a drought period. Unless there are large expanses of non-native turf and other thirsty plants, some quick-couplers (temporary hose connection) in conjunction with drip irrigation may be sufficient. However, many facility managers prefer the convenience an automatic irrigation system provides.

- Use of Mulches – The use of mulches on sloped areas along with terracing and plantings can help prevent runoff and erosion problems. The depth of mulch needed will depend on the type used. As a general rule, the coarser the material, the deeper it should be applied. A 3 to 4 inch layer of bark mulch should be sufficient. Mulch needs to be reapplied as it decomposes. The use of inorganic mulches such as pea gravel, crushed granite or pebbles in unplanted areas is encouraged. Such areas can become inexpensive pathways, utility areas, or decorative border strips. Don't use stone mulches in areas immediately adjacent to buildings, as they can heat up and cause glare. Medium colored stone, such as beige or light grey, is preferred over white, which causes glare, or black, which absorbs heat.

- Appropriate Maintenance – The maintenance requirements of a Xeriscape landscape are generally less than those of a conventional landscape. This is due to a reduction in turf area and unadapted plants that might have more disease, insect control, watering and fertilizer demands. However, there is no such thing as a maintenance-free constructed landscape. In general, a properly maintained yard is hardier and better able to withstand drought, freezing and pest problems. Obviously, landscape maintenance is up to the owner. However, there are things a builder can do to make maintenance easier.

E. Greywater Use

Greywater is defined as the wastewater produced from baths and showers, clothes washers, and lavatories. The wastewater generated by toilets, kitchen sinks, and dishwashers is called blackwater. The primary method of greywater irrigation that will be discussed is through sub-surface distribution.

The use of greywater for irrigation requires separate blackwater and greywater waste lines in facilities. This is not a difficult task in new construction but can be problematic in existing buildings.

Sub-surface distribution systems may be required by the local Health Department for greywater. Sub-surface systems are not as effective as above-ground spray systems for turf areas but are highly conserving and effective for providing root zone irrigation of plant beds, shrubbery, and trees. The best applications for greywater will be in conjunction with low water demanding landscapes such as Xeriscape.

The rules that govern greywater systems are currently based on modifications of septic system guidelines. Some variances are permitted for greywater since less volume is created than in a septic system. Low pressure dosing systems allow for uphill and smaller drainfields.

F. Harvested Rainwater

In this section, Harvested Rainwater is rainwater that is captured from the roofs of buildings on BLM property. Harvested rainwater can be used for indoor needs at a facility, irrigation, or both, in whole or in part.

The quality of rainwater can vary with proximity to highly polluting sources. However, in general, the quality is very good. The softness of rainwater is valued for its cleaning abilities and benign effects on water-using equipment. As an irrigation source, its acidity is helpful in the high PH soils of our region and, as one would expect, is the best water for plants.

Rainwater harvesting systems designed to fill all the water needs of a facility can be similar in cost to the expense of putting in a well. Operating costs for a rainwater system can be less. Rainwater collection systems designed to supplement the water needs of a facility already on the city system for irrigation purposes can be costly. The primary expense is in the storage tank (cistern). The cistern size for irrigation can be large due to the high temperatures and extended dry periods in the summer. If the system is not counted upon as the only source of irrigating water, building as large a cistern as one can afford is often the measuring gauge for cistern size.

III. ENHANCE INDOOR ENVIRONMENTAL QUALITY

The Environmental Protection Agency has determined that the average person spends 90% of their time indoors, and the indoor air quality and working environment can have a substantial effect on the person's health and work ethic. Every effort should be made to enhance the environmental quality of the DOI employee working indoors. This section will discuss 5 areas of the MOU that will have a measurable effect of the indoor working environment. Included below are samples to consider in the area of Enhanced Indoor Environmental Quality.

Included below are areas of consideration in the area of Indoor Environmental Quality:

Programmable Thermostat
Daylighting
Electromagnetic Fields
Paint, Stain, and Varnishes and Adhesives
Non-toxic Termite Control

A. Programmable Thermostat

A programmable thermostat senses the room temperature and controls the HVAC system according to a schedule established by the occupant. This type of thermostat allows different temperature settings to automatically regulate the HVAC system at different preset times.

A thermostat is usually the least costly component of a HVAC system. It can play a major role in the energy efficiency of the HVAC system. The goal of a setback thermostat is to regulate the HVAC system to maintain a desired comfort level when the building is occupied and then enter an economizing mode when the building is unoccupied. A double adjustment, during work hours and closed hours, will result in the greatest energy savings in the summer and winter. A single adjustment to an economizing mode each day also contributes significant savings.

Other conserving thermostats include electromechanical thermostats with setbacks and occupancy thermostats. The electromechanical types are lower cost and use bimetallic strips associated with a vial of mercury to make or break an electric current to operate the HVAC equipment. An occupancy thermostat maintains an energy conserving temperature until someone enters a room and presses a button to increase the temperature for a short period of time.

Programmable thermostats can require some effort to learn and master them. Several programmable units can accommodate different settings for every day of the week.

B. Daylighting

Daylighting optimizes natural sunlight entry into a building to minimize the need for artificial lighting. Artificial lighting is produced by electricity. Energy -efficient lighting is the use of artificial light to receive the optimal level of light for the lowest energy investment. Task lighting serves a limited area where a person's "work" is concentrated.

The central concern associated with daylighting is the heat gain that can result when natural light is brought into a building. In some regions, this is an especially important concern. During the heating season, the heat gain from natural light can be useful.

Another concern with natural light is the ultraviolet (UV) rays in natural light. When natural light strikes fabrics and some other materials, the UV rays can discolor and weaken the material.

There are simple design strategies and some materials that can facilitate the energy saving advantages of natural light. Light colored interiors and open floor plans are good choices. This approach also augments artificial light efficiency.

Energy efficient lighting is not simply finding the most light for the least wattage or the longest lasting light bulb. Proper sizing of the light to the needs of the location and the tasks that will be performed, called task lighting, is an energy saving strategy.

C. Electromagnetic Fields

Electromagnetic fields (EMFs) are created by electric power charges. There are two types of fields - electric fields which result from the strength (voltage) of the charge and magnetic fields which result from the motion (amperage) of the charge.

There is considerable scientific inquiry into possible health impacts from electromagnetic fields. There are several studies indicating that health risks exist, but little agreement as to why. A draft study by the EPA, which reviewed 50 epidemiological studies and hundreds of biological studies acknowledge that low level electromagnetic fields may increase the risk of cancer. The study indicated the need for more research into understanding the risk components and exposure levels.

The recommended course of action at present is "prudent avoidance." This means it's a good idea to pursue no-cost or minimal-cost strategies that reduce exposure to EMF's. Major investment in minimization strategies is not considered "prudent," due to the lack of adequate understanding of what is or is not safe.

Electromagnetic fields diminish quite rapidly with distance from the source (the inverse square of the distance). Thus, a primary strategy is to increase the distance between sources of EMF's and parts of the building where people spend the most time. Reducing the sources of EMF's can also be accomplished to a limited extent.

EMF sources include electrical distribution lines and common household and occupational electrical appliances.

D. Paint, Stain, and Varnishes and Adhesives

This section addresses finishes such as paint, stain, and varnishes and adhesives that can be applied on-site.

Most finishes and adhesives contain volatile organic compounds (VOCs) which outgas and adversely affect indoor air quality. Lower VOC and non-VOC products are now readily available from many companies as an alternative.

The Environmental Choice(TM) Program in Canada has established minimal VOC standards for finishes to receive their Eco Logo(TM). The Environmental Choice(TM) program recognizes negative impacts on the environment and people from VOCs. California and a number of other states have now adopted and sometimes improved upon those Canadian standards.

Low biocide paints avoid the fungicides and mildewcides typically added to latex paint to extend shelf life. These additives are considered harmful to indoor air quality and are specifically avoided by environmentally sensitive persons.

Natural plant/mineral-based finishes and adhesives are available from three German companies. They cost 2 to 2 1/2 times more than standard products. Low biocide and VOC paints also cost more. Low biocide paints can spoil if not used quickly.

E. Non-toxic Termite Control

Non-toxic termite control is the use of termite prevention and control without chemical use. Instead, physical controls are installed during construction such as sand barriers or metal termite shields. If termite infestation does occur, least toxic methods of treatment are used.

In areas that have subterranean termites that live in the soil and drywood termites that attack dry wood there is a greater than 70 percent probability that wooden structures will be attacked by termites within 10 to 20 years. Termite problems within one year after construction have been reported.

When wood is used as a building material, termite prevention in the form of treated wood or naturally resistant wood will be required by building codes. Typically, chromated copper arsenate (CCA) pressure-treated wood is used. Two alternative chemical substances have gained popularity as more toxic substances such as chlordane have been banned for soil treatment. These include organophosphates and pyrethroids. However, these chemicals are toxic to people as well as termites, and can offgas and leach out into the soil and water table. They can be absorbed through the skin, lungs and through ingestion. Exposure to small children, workers, chemically-sensitive individuals and animals can lead to serious health problems.

Less toxic wood treatments are available. (See Wood Treatment Section) However, alternatives to wood treatment and chemical treatment can be quite effective. Least-toxic strategies must be used in combination to achieve maximum effectiveness. Few pest control managers expect non-toxic methods to completely replace chemical use. However, they offer considerable potential for the reduction of chemical use, and may prevent such use in all but extreme situations.

IV. REDUCE ENVIRONMENTAL IMPACT OF MATERIALS

There are many ways to minimize the environmental impact of materials on the environment. Rather than building anew, recycle or adaptively reuse a building for a new purpose. The designing of flexible interiors that can be converted to other uses reduces the need for redesign and reconstruction of interior spaces. Encourage visitor and employee recycling through well-placed and marked containers and awareness programs. Seek building materials with high recycled content and low “embodied energy”.

Included below are areas of consideration in the area of Recycling and Building Materials.

Dimensional Lumber	Wood Treatment
Engineered Structural Products	Engineered Sheet Materials
Flyash	Alternative Wall Construction
Non-wood Flooring	Wood Flooring
Roofing	Structural Panels
Insulation	Composite Materials
Cabinets	Straw Bale Construction
Compost	Construction Waste Recycling
Biobased Products	

A. Dimensional Lumber

Dimensional lumber refers to the wood used in constructing the wall, floor and roof framing of a building.

Most buildings are constructed with wood framing. Although wood is a renewable resource, the amount of wood required for construction purposes is taxing the regenerative capabilities of this resource, as well as depleting a critical component in ecological balance. Trees affect water quality, rainfall, and air quality, both in the immediate region and on a global scale.

Although the status of the wood resource is hotly debated, it is clear that expanding demand simply due to population growth has or will have an impact on its long term viability. The reduction of primary forest cover has spurred further debate on the management of the forests as balanced ecosystems. Some new management approaches are based upon holistic sustainable principles. The principles of sustainability which underpins the Green Builder Program favors forest management practices that retain natural forest ecosystems.

Wood from old growth forests is not identified in final products, making the option of avoiding it very difficult. Most of the old growth trees are in Redwood and Douglas Fir regions; however, wood of these species exists that is not from old growth areas.

The increased use of engineered wood from all species reduces waste and is beneficial. Additionally, using smaller dimensional wood (less than 2x10) allows smaller trees to be used which can be helpful in tree farming rotations.

B. Wood Treatment

Wood treatment refers to protecting wood from damage caused by insects, moisture, and decay fungi.

Three primary methods of wood treatment currently prevail: creosote pressure-treated wood, pentachlorophenol pressure-treated wood, and inorganic arsenical pressure-treated

wood. The pressure-treating process is done by commercial facilities and made available to users in the final wood product. Copper napthenate, zinc napthenate, and tributyltin oxide are other wood treatment options that can be site applied. All of these treatment processes involve dangerous chemicals .

Chromated copper arsenate (CCA) is the most popular wood treatment product available today. The chemicals are inert within the material and offer protection from moisture and decay fungi. The chemicals do not penetrate into the heartwood effectively so a sealer is advisable on cut ends of CCA treated wood. Although CCA treated wood is sawn on jobsites, hardly anyone seals the cuts. All pressure treated products require adherence to safety precautions approved by the EPA. The safety precautions are listed in the Guidelines section.

EPA regulations govern the manufacture of pressure-treated materials and require extensive environmental safety precautions. Wood treatment does offer a method to extend the usable life of our wood resources.

The toxicity of the chemicals used in wood treatment has led to research into less toxic methods such as the use of borates derived from the natural element boron (borax). Borates (from boron) are used in wood in New Zealand and Australia and offer insect protection and fire retarding benefits to wood. Full-scale commercial introduction of borates in the U.S. awaits resolution of the leaching problem of borates. Since borates are water soluble, water dilutes them and leaves the wood unprotected from decay after a period of time. In a location unexposed to water, they are effective in preserving wood; site applied borate products are available.

Borate pressure-treated wood is being offered by one company in the U.S. (primarily for the Caribbean market). They are promoting the concept of using borates for all the wood in a facility. This eliminates the need for termite protection by any other means and prevents decay fungi.

Ammoniacal copper quatenary (ACQ) is a new wood preservative currently being introduced. This material employs preservative components that are listed in EPA's classification as "General Use" pesticides. This is a less toxic material than CCA and it performs similarly.

C. Engineered Structural Products

Engineered structural products are recycled/reconstituted wood materials that employ laminated wood chips or strands and fingerjointing (the gluing of larger pieces together).

These materials fall into the general category of engineered wood. This means that the tolerances in stability, consistency, straightness, and strength are more precise than dimensional lumber, making the products easier to work with. In joist and rafter applications, the reconstituted products are particularly useful for long spans without bowing or lateral movement.

These materials drastically minimize the amount of waste created in processing the raw materials. Waste wood and entire trees, regardless of species, shape, and age, can be used in making these products.

Fingerjointed studs reduce waste in two ways. Short pieces that normally would be unusable are combined rather than disposed and the engineered quality of fingerjointed materials eliminate warping or cracking. The strength of the joints in good quality material is such that the solid wood portions will be more likely to break than the adhered fingerjoint.

D. Engineered Sheet Materials

Engineered sheet materials can be made of recycled-content or reconstituted materials.

Recycled content sheet products include any percentage of recycled material. Products that use recycled newsprint, agricultural byproducts, or wood waste are considered recycled content materials.

Reconstituted materials use chipped or stranded small-diameter trees as their wood source. This material is then bound together into forms suitable for building.

Products exist that contain recycled post-consumer paper, by-product gypsum and recovered gypsum, wood waste, wood chips from "non-commercial" trees, and annually-renewable agricultural fibers. These materials include: hardboard made from waste wood; wallboard made from perlite, gypsum, and recycled post-consumer newsprint; 100% recycled newsprint fiberboard; and fiberboard made from straw.

Some of these materials need to be kept dry during the construction process. Binders used in some of these materials may outgas. It is best to avoid materials that contain urea formaldehyde. Phenol formaldehyde is predominantly used in materials for exterior applications. where its lower outgassing qualities are not considered health threatening.. Most of these materials are installed/applied in the same manner as the traditional products (plywood), therefore labor estimates are comparable. Oriented-strand board (OSB) is a reconstituted material that is now commonly used.

E. Flyash

Flyash is defined in Cement and Concrete Terminology (ACI Committee 116) as "the finely divided residue resulting from the combustion of ground or powdered coal, which is transported from the firebox through the boiler by flue gases." Flyash is a by-product of coal-fired electric generating plants.

Two classifications of flyash are produced, according to the type of coal used. Anthracite and bituminous coal produces flyash classified as Class F. Class C flyash is produced by burning lignite or subbituminous coal. Class C flyash is preferable for the applications

presented in the Whole Building Design Guide and is the main type offered for building applications from ready-mix suppliers.

Flyash is one of three general types of coal combustion byproducts (CCBP's). The use of these byproducts offers environmental advantages by diverting the material from the wastestream, reducing the energy investment in processing virgin materials, conserving virgin materials, and allaying pollution.

Although flyash offers environmental advantages, it also improves the performance and quality of concrete. Flyash affects the plastic properties of concrete by improving workability, reducing water demand, reducing segregation and bleeding, and lowering heat of hydration. Flyash increases strength, reduces permeability, reduces corrosion of reinforcing steel, increases sulphate resistance, and reduces alkali-aggregate reaction. Flyash reaches its maximum strength more slowly than concrete made with only portland cement. The techniques for working with this type of concrete are standard for the industry and will not impact the budget of a job.

F. Alternative Wall Construction

Wall-form products have hollow interiors and are stacked or set in place and then filled with steel-reinforced concrete creating a concrete structure for a building.

Some wall-form materials are made from EPS (expanded polystyrene) which is a lightweight non-CFC foam material. There are also fiber-cement wall-form products that can contain wood waste. The EPS/concrete systems offer high insulating qualities and easy installation. The fiber-cement blocks offer insulating qualities as well. Some EPS products also have recycled content.

The type of materials available locally will of course vary depending upon the conditions in the area of the building site.

In many areas in the west, indigenous stone, such as limestone, marble, granite, and sandstone are in great numbers. It mat be cut in quarries or removed from the surface of the ground (flag and fieldstone). Ideally, stone from the building site can be utilized. Depending on the stone type, it can be used for structural block, facing block, pavers, and crushed stone.

Most brick plants are located near the clay source they use to make brick. Bricks are molded and baked blocks of clay. Brick products come in many forms, including structural brick, face brick, roof tile, structural tile, paving brick, and floor tile.

Caliche is a soft limestone material which is mined from areas with calcium-carbonate soils and limestone bedrock. It is best known as a road bed material, but it can be processed into an unfired building block, stabilized with an additive such as cement. Other earth materials include soil blocks typically stabilized with a cement additive and produced with forms or compression.

Rammed Earth consists of walls made from moist, sandy soil, or stabilized soil, which is tamped into form work. Walls are a minimum of 12" thick. Soils should contain about 30% clay and 70% sand.

The use of locally available and indigenous earth materials has several advantages in terms of sustainability. They are:

Reduction of energy costs related to transportation.

Reduction of material costs due to reduced transportation costs, especially for well-established industries.

Support of local businesses and resource bases.

Care must be taken to ensure that non-renewable earth materials are not over-extracted. Ecological balance within the region needs to be maintained while efficiently utilizing its resources. Many local suppliers carry materials that have been shipped in from out of the area, so it is important to ask for locally produced/quarried materials.

Both brick and stone materials are aesthetically pleasing, durable, and low maintenance. Exterior walls weather well, eliminating the need for constant refinishing and sealing. Interior use of brick and stone can also provide excellent thermal mass, or be used to provide radiant heat. Some stone and brick makes an ideal flooring or exterior paving material, cool in summer and possessing good thermal properties for passive solar heating. Caliche block has been produced for applications similar to stone and brick mentioned above. Caliche or earth material block has special structural and finishing characteristics.

Rammed earth is more often considered for use in walls, although it can also be used for floors. Rammed earth and caliche block can be used for structural walls, and offer great potential as low-cost material alternatives with low embodied energy. In addition, such materials are fireproof.

Caliche block and rammed earth can be produced on-site. It is very important to have soils tested for construction material use. Some soils, such as highly expansive or bentonite soils, are not suitable for structural use. Testing labs are available in most areas to determine material suitability for structural use and meeting codes.

G. Non-wood Flooring

The floor coverings addressed in this section pertain to non-wood flooring: carpeting and its padding, tile products, and linoleum (as opposed to vinyl). These are coverings that would be used in all the primary areas of a facility. (Wood flooring is addressed separately.)

Recycled-content carpet padding comes in two primary types - from old padding and from reclaimed carpet fibers.

Recycled-content carpeting is made from recycled PET derived primarily from post-consumer plastic soft drink containers.

Natural linoleum is made from softwood powder, linseed oil, pine tree resins, cork, chalk, and jute backing.

Recycled-content tile that is currently available is made from waste glass such as lightbulbs and auto windshields. An additional recycled-content tile is made from a byproduct of feldspar mining.

Natural carpets are those made from grasses, cotton, and wool with minimal treatment.

Common floor coverings are most often cited as primary contributors to indoor air contamination. This is due to the VOC constituents (volatile organic compounds) present in the binders used in the fabrication of the materials such as carpet padding and carpeting and in the adhesives used to apply carpet padding and tile.

Since buildings are now constructed tightly in order to conserve energy, chemicals outgassing from building materials are more potent and harmful. Formaldehyde outgassing is a primary threat from commonly-used floor coverings.

Airing a building before it is occupied will dilute the chemicals during their most potent initial stage. However, high levels of VOC's will outgas for months and, in many cases, will continue to outgas for years. Reducing the application of VOC's in the building can be achieved through alternatives - mainly associated with the use of carpeting.

This section identifies recycled-content materials which are durable, high quality, and attractive floor coverings. The use of these materials strengthens the viability of our recycling efforts and greatly benefits our resource and energy impacts.

Linoleum and natural carpets use renewable resources and offer durability without compromising aesthetics. The cork used in linoleum is harvested from the cork tree on an ongoing basis without harming the tree. Along with cotton and wool, carpet-type floor coverings are available from grasses and reeds.

Ceramic tile offers outstanding durability and maintainability. It also has high aesthetic value.

H. Wood Flooring

Wood flooring in this section refers to finish floors that can be in strips or parquet and nailed or glued to a subfloor.

Wood flooring is considered an aesthetic plus to buildings. It also offers long life and fairly easy maintenance.

Reused wood flooring is often derived from remilled salvage timbers. It can also be salvaged from old flooring. From an environmental standpoint, this approach saves materials from the wastestream and does not impact living trees. Very often the reused wood flooring comes from trees that are no longer present to harvest, or in grain patterns only found in rare old large trees. This adds to the aesthetic quality of this type of flooring.

The finishes selected for wood flooring and any adhesives used should contain low VOC content.

I. Roofing

This section deals with roof covering materials such as shingles, tile, and roof panels.

In selecting material for roof covering one should take into account its weight (heavier material requires larger support members), its durability (e.g. how well can it tolerate high and low temperatures and for how long), its effect on water falling on the roof if the water is being captured (for example, will gravel from shingles build up sediment in a cistern or do roof materials leach into the water?), the heat-holding qualities of the roof material (does it heat up and stay hot into the night?), as well as cost, fire rating, maintainability, and installation characteristics.

Slate, clay, and cementitious roof materials offer excellent durability but are heavy. Fiber-cement composite roof materials are somewhat lighter and use fiber materials resourcefully. Some use waste paper as well as wood fiber. Many have 60 year warranties.

Metal roof materials, steel and aluminum contain high percentages of recycled content, up to 100% in many aluminum products. An additional advantage is that these materials are easily recycled in their post-use as well as lightweight and durable.

Asphalt shingles use recycled, mixed paper in their base and some use reclaimed minerals in the surface aggregate. This type of material does not last as long as the others mentioned above. Recycled plastic roof materials are starting to be introduced as a lightweight option.

J. Structural Panels

Structural panels are typically two outer layers of structural sheathing material separated by an insulated core. They are made in different sizes according to the job's requirements.

Structural panels replace the standard stud/insulation/sheathing wall system. Some panels have sheetrock mounted on the inside portion, and/or siding on the exterior. Most have sheathing such as oriented strand board (OSB) for facings.

Panels can be fabricated with three types of foam cores: molded expanded polystyrene (MEPS), extruded polystyrene (XEPS), and urethane (polyurethane and polyisocyanurate are types of urethane). There are several options for facings: plywood, waferboard, oriented strand board (OSB), sheetrock, and metal. Exterior surface materials such as T-1-11 siding are offered by some suppliers. XEPS and urethane foam use CFC's or HCFC's as blowing agents. MEPS does not use any ozone-depleting chemicals. For credit from the LEEDS or Green Globes, MEPS insulation or an alternative that has no ozone-depleting chemicals must be used. Additionally, waferboard, OSB, sheetrock and/or siding need to be used as facings.

Foam insulation can attract insects. Some companies use borates as an insect barrier in the foam insulation. This is a preferred strategy for protecting the panels. Borates are also topically applied to the facings by some companies.

Structural grade adhesives should be used to bind the facings to the foam core. Use the manufacturer warranty as a gauge of the quality of the product. Poor adhesive qualities can cause panel failure. Select panels that are certified to meet building codes.

Structural panels offer very effective insulating qualities, rapid installation, and consistent quality (minimizing waste). The use of OSB or waferboard for facings is considered a positive use of wood resources.

K. Insulation

There are several types of insulation addressed in this section that can be used in walls, floors, and ceilings.

Cellulose insulation is made from recycled newspaper and treated with fire retardants and insect protection. Borates, derived from the mineral Boron, are natural materials that can be used as fire retardants and insect repellents in cellulose insulation.

CFC and HCFC insulation refers to the blowing agents that contain chlorofluorocarbons used in making many rigid insulating sheathing products. Extruded polystyrene and polyisocyanurate foam insulation boards are currently made with CFC or HCFC blowing agents.

Agricultural fiber insulation is available in the form of cotton insulation made with mill waste, low grade, and recycled cotton. It is treated with a non-toxic fire retardant and comes in batts comparable to fiberglass insulation batts.

Cementitious foam insulation is made from magnesium from sea water and blown in place with air.

Perlite insulation is made from a natural occurring volcanic mineral and is often used as loose fill insulation in concrete block cavities.

Insulation materials play a primary role in achieving high energy efficiencies in buildings. There has been concern over the health impacts of the material constituents of insulation ever since the problems associated with asbestos became apparent, followed by the banning of urea formaldehyde based insulation. The health concerns have currently spread to fiberglass and cellulose insulation.

Fiberglass is considered a risk by some because of the insulation fibers ability to become airborne and be inhaled similar to asbestos.

Cellulose insulation uses recycled newsprint that contains printers inks which can possibly outgas formaldehyde into a facility. If there is any outgassing from inks, it should fall well below levels irritating most persons. However, an environmentally-sensitive person should be careful in selecting cellulose and install a vapor retarder between the insulation and the living space. (Note that the vapor retarder can exacerbate mildew problems if humidity levels in the facility are high.)

There are also chemical additives often added to treat cellulose that are not thoroughly understood from an indoor air quality standpoint. Cellulose insulation that is treated with borates is preferred. Cellulose insulation can be bound together as a wet spray and installed in open wall cavities where it effectively seals the entire wall.

Rigid board insulations employed as sheathing on facilities have played an important role in achieving high R-values. The use of CFC's in many of these materials has caused increased release of chlorine molecules into the atmosphere contributing to ozone depletion. HCFC's outgas a lesser amount of chlorine molecules. However, the severity of the ozone depletion situation has led to the recommendation to avoid both types of insulation blowing agent. Alternatives in rigid board insulation are available that do not use CFC's. (See Engineered Sheet Products section.) Any rigid expanded polystyrene insulation does not have CFC's.

Cementitious foam insulation is available commercially in one product: Air-Krete. It is also more costly where available. This type of insulation is considered the most benign from an indoor air quality standpoint.

Perlite insulation is in a loose form suitable to fill the cavities in building block. Perlite can be bound into other materials and used in sheet form. It is commonly used in commercial roofing material and can be used as an aggregate in concrete. It is non-flammable, lightweight and chemically inert.

Rockwool is recycled steel slag (a landfill material). It is available as blow-on wall insulation (a starch binder is used) and as loose blow-in attic insulation. It offers very good energy performance, will not burn, and is chemically inert.

L. Composite Materials

Composite materials use stable, durable materials, some of which are byproducts. Fingerjointed windows use small pieces of wood reducing the impact on large clear grained wood sources. Recycled windows can mean reuse of salvaged windows or windows of recycled content.

Recycled/reconstituted doors are typically molded hardboard materials. Domestic hardwood veneers use a stable resource and assist our national economy. Some hardwood veneers such as luaun are from tropical mahogany trees. Domestic hardwood panel doors use wood types which are a stable resource in our economy. The panel style reduces the need for potentially harmful adhesives. Recycled doors are reused doors salvaged from earlier projects.

Windows and doors are currently highly engineered in order to optimize energy performances. Windows and doors have significant roles in the energy profile of a building. Frame material issues, although important as part of an overall environmentally responsible approach, play only a small role due to their small size/area. Performance of these products is important in durability and maintenance, as well as energy.

Modern composite products are easy to care for, and their thermal performance is superior to wood. One door manufacturer has introduced recycled-content jambs using recycled plastic and cedar byproducts. Molded hardboard doors have become the preferred interior door and are a good use of lumber mill waste shavings.

The reuse of existing materials is the most resourceful building material option. Make certain that quality and durability are not compromised.

Make certain seals and gaskets are in good condition when selecting recycled windows.

Any windows using fingerjointed materials will need to be painted for aesthetic reasons. It is best to have the windows factory primed where the painting is done in controlled conditions.

M. Cabinets

This section pertains to interior storage cabinets.

Most conventional cabinets are made of plywood with interior grade glue, particle board, or medium density fiberboard all of which outgas urea formaldehyde. The use of solid wood, metal, or formaldehyde-free materials will mitigate a potential indoor air quality problem. A low pressure laminate such as melamine can seal in urea formaldehyde.

The costs of employing these alternative materials are higher than conventional materials. An additional option is to seal the particleboard, interior plywood, or medium density fiberboard (MDF) components with a finish that prevents outgassing. This should be done prior to installation since it is necessary to access all the edges and backs.

Solid domestic hardwood cabinets use a wood resource (domestic hardwood trees)which has a positive growth/removal rate on a national basis (trees are growing at a faster rate than they are being removed). Any solid wood components of cabinets using MDF or plywood can also be specified to be a domestic hardwood.

N. Straw Bale Construction

Straw bale construction uses baled straw from wheat, oats, barley, rye, rice and others in walls covered by stucco. Straw bale are traditionally a waste product which farmers do not till under the soil, but do sell as animal bedding or landscape supply due to their durable nature. In many areas of the country, it is also burned, causing severe air quality problems. It is important to recognize that straw is the dry plant material or stalk left in the field after a plant has matured, been harvested for seed, and is no longer alive. Hay bales are made from short species of livestock feed grass that is green/alive and are not suitable for this application. Hay is also typically twice the price of straw.

This technique for constructing walls has been recently revived as a low cost alternative for building highly insulating walls. The technique was practiced in the plains states in the latter 1800's and early 1900's. Many of the early structures are still standing and being used. The technique has been applied to homes, farm buildings, schools, commercial buildings, churches, community centers, airplane hangars, well houses, and more. Government buildings have also been constructed of these materials

Straw is also being used as a building material currently in sheet materials such as sheathing and wall panels. However, the approach of using bales directly, despite its history, is a new technique from a regulatory standpoint.

Building walls with straw bales can be accomplished with unskilled labor, and the low costs of the bales make this technique economically attractive. However, it is important to realize that the cost of straw bales will differ depending on what time of year they are harvested and how far they need to be transported. They are cheaper at the time of harvest rather than after they have been stored from the previous season and, of course, cheaper if they are transported shorter distances. Bales must also be protected from getting wet. Costs also begin to rise when one considers the type of stucco and its application. A mud plaster taken from site soil, applied by the owner/builder, and maintained by the owner is quite inexpensive, but may take a long time to apply. A cement stucco applied by a contractor is accomplished quickly and lasts a very long time without any maintenance, but also costs money. As with any style of construction, the more labor input by the owner and the less by the contractor, the less costly it will be.

Two basic styles of straw bale construction have been used: post and beam construction with straw bale infill, and structural straw bale construction or "Nebraska" style (the weight of the roof is supported by the bales).

O. Compost

Compost is created by the decomposition of organic matter such as yard waste. *Compost systems* confine compost so that it can receive air and create suitable temperatures for proper decomposition into fertilizer.

Composting results in: (a) saving landfill space, (b) saving energy for transporting the material, and (c) the creation of a high quality fertilizer at the location where it can be used (thereby again saving energy). In addition, plastic garbage bags are saved.

Animal-based food products should not used to create compost. The compost system should function without odors or difficult labor. Prefabricated composting bin systems are available commercially and can function well with minimal maintenance.

Vermiculture, or composting using worms, can be accomplished as an alternative approach to traditional composting methods. Guidance is available from trained persons in Austin.

P. Construction Waste Recycling

Construction waste recycling is the separation and recycling of recoverable waste materials generated during construction and remodeling. Packaging, new material scraps and old materials and debris all constitute potentially recoverable materials. In renovation, appliances, masonry materials, doors and windows are recyclable.

8,000 lbs of waste are typically thrown into the landfill during the construction of a 2,000 square foot facility.

Most construction waste goes into landfills, increasing the burden on landfill loading and operation. Waste from sources such as solvents or chemically treated wood can result in soil and water pollution.

Some materials can be recycled directly into the same product for re-use. Others can be reconstituted into other usable products. Unfortunately, recycling that requires reprocessing is not usually economically feasible unless a facility using recycled resources is located near the material source. Many construction waste materials that are still usable can be donated to non-profit organizations. This keeps the material out of the landfill and supports a good cause.

The most important step for recycling of construction waste is on-site separation. Initially, this will take some extra effort and training of construction personnel. Once

separation habits are established, on-site separation can be done at little or no additional cost.

The initial step in a construction waste reduction strategy is good planning. Design should be based on standard sizes and materials should be ordered accurately. Additionally, using high quality materials such as engineered products reduces rejects. This approach can reduce the amount of material needing to be recycled and bolster profitability and economy for the builder and customer.

Q. Biobased Products

The term 'biobased product' as defined by Farm Security and Rural Investment Act (FSRIA), means a product determined by the U.S. Secretary of Agriculture to be a commercial or industrial product (other than food or feed), that is composed in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials.
In short, biobased industrial products are produced from renewable plant and animal sources, and are generally presumed to be more environmentally benign than their petroleum based counterparts. They are usually biodegradable and can be returned to the earth at the end of their useful life or recycled and used again.

FSRIA creates a procurement program that will require federal agencies to purchase biobased products, unless those products are 1) not reasonably available; 2) fail to meet performance standards; or 3) are available only at an unreasonable price. The website www.biobased.oce.usda.gov will provide product information from manufacturers and vendors of biobased products to aid federal agencies in their selection of biobased products. This website will provide a portal for biobased product manufacturers/vendors to submit information and data about their products along with independent lab test results on the products biobased content and other key information that federal agencies will need to consider when buying biobased products.

There are a variety of significant reasons why biobased products provide excellent alternatives for existing products derived from petroleum:

1. Biobased products are domestically produced and support the U.S. economy.
2. Biobased products reduce our country's dependency on foreign energy.
3. Biobased products are generally better for the environment to produce and use.
4. Biobased products support our farmers and rural communities.

The USDA has assembled a list of biobased items that can be used in construction and maintenance field. These items were developed and prioritized for designation by evaluating them against program criteria established by the USDA in conjunction with other government agencies, private industry groups and independent manufacturers.

A list of current biobased items have been issued by the USDA. Below is a list of products that are all biobased and being used in the construction field. This list is far from complete and to access the entire list you can access the USDA web site for biobased products at www.biobased.oce.usda.gov .

Water Tank Coatings	Durable Foams
Biobased Carpet	Storm Drain Filtering Inserts
Dust Suppressant	Biofluid-Filled Transformers
Diesel Fuel Additives	Composite Panels
Concrete & Asphalt Form Release	Roof Coatings
Insulating Foams for Wall Construction	Polyurethane Coatings
Molded Composites	Interior Wall & Ceiling Patch
Hydrocarbon Spill Remediation Materials	Concrete & Asphalt Cleaner
Wood & Concrete Sealers & Coatings	Biodegradable Foams
Compost Erosion Control	Interior Paints and Coatings
Exterior Paints and Coatings	Floor Coverings (Non-Carpet)
Concrete Curing Agents	Lumber Substitutes
Home & Office Adhesives	Fire Retardants

V. TOTAL BUILDING COMMISSIONING

ASHRAE Guideline 0-2005, The Commissioning Process, defines commissioning as "a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria". Commissioning is a quality assurance-based process that formalizes review and integration of all project expectations during planning, design, construction, and occupancy, along with functional testing and verification. Commissioning is occasionally confused with testing, adjusting, and balancing (TAB) which is only one component of the commissioning process that verifies that the energy related systems installed perform according to project requirements.

Commissioning also can be applied to existing buildings to restore them to optimal performance. Retrocommissioning is a systematic, documented process that identifies low-cost O&M improvements in an existing building and brings that building up to the design intentions of its current usage.

A. Commissioning and Green Buildings

Many owners assume that the green certification process and the commissioning process are identical. Coordination of the green certification process is beyond the scope of the commissioning provider associated with a green project. Usually a project team member is appointed as the coordinator of the green certification process.

Commissioning is especially important for green buildings because these projects utilize new construction techniques and materials. Green buildings often employ systems that use renewable resources. All of these technologies can make a significant contribution to the sustainability of a project, but they add complexity. Commissioning can ensure that the green concepts of the designer are developed and articulated in the design documents and provides verification of the performance of the green design features after the building is complete.

Commissioning a green building ensures that:

- The design meets the desired green building certification criteria.
- Green materials are adequately specified and installed
- The green products or features will not have a negative impact on other building systems or ongoing O&M.
- The design decisions are adequately documented.
- Specific performance criteria are developed for each green feature.
- O&M documentation and staff training is provided so facility staff can properly maintain the green features.

B. Benefits

A properly commissioned building can result in fewer change orders during construction, reduced equipment replacement costs, improved coordination between design, construction, and occupancy, and a reduction in O&M costs. The cost of commissioning should be a line item in the project cost estimate. The average cost of total building commissioning, from design through warranty, varies from 1% - 2.5% of the construction cost depending on the complexity of the facility. If the commissioning scope only includes the HVAC system and automated control systems then cost is based on 1.5% to 2.5 % of the mechanical contract.

C. Commissioning Provider and Commissioning Team

Many owners who have commissioned their buildings recommend using an independent third party as the commissioning provider. An independent provider ensures that the

owner receives the anticipated building performance. Commissioning team members often include the owner or project manager, commissioning provider, design team, installing contractors, and facility staff. The commissioning team does not manage the design and construction of the project. Its purpose is to promote communication among team members and to provide early identification and resolution of problems. However, the commissioning provider can advise the owner on the consolidation of roles and tasks to best fit the complexity of the project.

D. Attributes of Building Commissioning

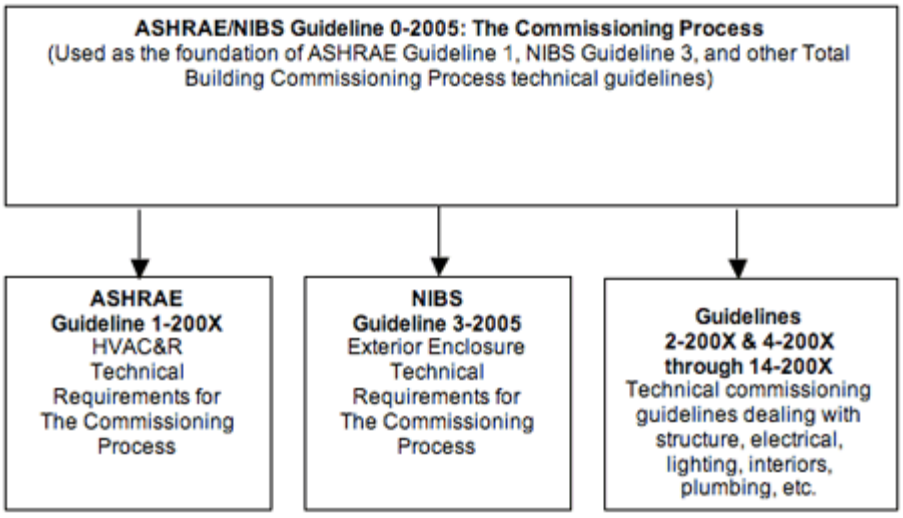
Total building commissioning is achieved ideally by beginning in the pre-design phase with design intent development and documentation, continuing through design, construction and the warranty period, accompanied by testing and verification. In each phase, a commissioning provider works with various project team members to coordinate the commissioning process. The goal is to ensure systems integration and overall quality assurance. Owners who decide to commission their buildings should anticipate the following written deliverables:

- Commissioning plan and schedule detailing each step of the process and each team member's role and responsibilities.
- A diagnostic and functional test plan
- A list of findings and potential improvements for the design and construction phases
- A training plan with schedule
- Final commissioning report detailing all findings, including functional performance test data.
- Systems concept and operations manual featuring special instructions for energy efficient operation
- Energy savings and implementation cost estimates

E. Conclusion

Recent case studies conducted in private sector facilities have shown that the Commissioning Process can improve new building energy performance by 8% to 30%. Implementing regular, sound operation and maintenance practices ensures that the savings from commissioning last.

It is highly recommended that project teams who employ the Commissioning Process should follow the process outlined in ASHRAE Guideline 0-2005. Guideline 0-2005 presents a standard process that can be followed to commission any building system that may be critical to the function of a project.



NIBS Guideline 3 (Draft Version)--Total Building Commissioning (TBC) Process

LEED-NC Version 2.2 Reference Guide outlines requirements for fundamental commissioning of a building's energy systems for certification. Additional credits may be achieved by pursuing Enhanced Commissioning which includes additional commissioning activities after systems performance verification is completed. Enhanced Commissioning begins early in the design process.

Building commissioning can ensure that a new building begins its life cycle at optimal productivity, and improves the likelihood that the building will maintain this level of performance. Regardless of the commissioning approach and system focus, it always requires clear definition of performance expectations, rigor in planning and execution, and thorough project testing, operational training, and documentation. Below are sources available to help in understanding and adopting commissioning into project acquisition plans.

ASHRAE Guideline 0 - 2005: The Commissioning Process—the industry-accepted Commissioning Guideline. Includes the Total Building Commissioning Process as defined by National Institute of Building Sciences (NIBS).

National Institute of Building Sciences (NIBS) Commissioning Process Guideline 0.

LEED-NC Version 2.2 Reference Guide, U.S.Green Building Council

The Building Commissioning Guide, U.S. General Services Administration, 2005.

Attachment 5

DOE High Performance Buildings Database: Available Input Fields

Table of Contents

This document shows the fields available for describing a project in the U.S. Department of Energy's High Performance Buildings Database. You can use this document to assess what information will be needed to document your project.

Information that must be provided for a project to be considered for publication by U.S. DOE is indicated with an asterisk after the field name. While most fields are optional, the more information you provide, the better your project will look when published.

There is no need to collect all the information in advance because after you begin entering a project online you can save it and return to it as many times as you like to complete the data entry.

Additional instructions and guidance for each field are provided on the online help screens listed for each section. Text fields are not limited in length--feel free to provide as much detail as you can. Formatting (bold, italics) will not be retained unless you use html tags to encode it. Leave a blank line between paragraphs.

Authorization to release information from online form:
By logging in to enter data or images into this database you agree that any information you provide may be distributed freely to any users of this database or other information resources created from this database, and that you have the authority to release this material. You also certify that the information you provide is, to the best of your knowledge, accurate.

Important Note:

This form was updated on: March 9, 2005

If more than six months haved passed, please check the online submission page for an updated version.

General Information

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?GeneralScreen

Identifying information

Short project name*: _____

Full project name: _____

Default units of measurement*: _____ [English; metric]

Project owner*: _____

Owner type: _____

[Corporation, for-profit; Corporation, nonprofit; Individual(s); Federal government; State or local government]

Project size*: _____ [ft2; m2]

Number of stories _____

Project location

Address: _____

_____

City*: _____ State*: _____

Zip; postal code: _____ Country*: _____

Latitude _____ Degrees _____ Minutes [north/south]

Longitude _____ Degrees _____ Minutes [east/west]

Elevation _____ [ft./meters]

Site context/setting

_____ [urban/suburban/rural]

Occupancy

Primary occupant type: _____

[Corporation, for-profit; Corporation, nonprofit; Individual(s); Federal government; State government; Local governr

Owner occupied? _____ [yes; no]

Typical number of permanent occupants: _____ people

Average hours per permanent occupant _____ hours per week

Typical number of visitors per week _____ people

Average hours per visitor _____ hours per week

Details about occupancy:

Scope

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?ScopeScreen

Number of buildings*

Single building [ ]

Multiple buildings [ ] How many? _____

Size of typical building(s)

Building 1 _____ [ft2; m2]

Building 2 _____ [ft2; m2]

Building 3 _____ [ft2; m2]

Building 4 _____ [ft2; m2]

Building 5 _____ [ft2; m2]

Part of a building [ ] Approximate portion of building included in project? _____ %

Related projects

[Associate this project] with an "umbrella" project

[Create a link] to additional projects within this "umbrella" project

History and completion date

Percent new* _____ %

Percent renovation* _____ % Historic? _____ [yes; no]

Year of construction: _____

Year of last major renovation: _____

Date of completion /occupancy _____ (m/yyyy)

Completion date notes:

Building Types

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?BuildingTypes

Building types*

Select all that apply

[ ] Commercial office
[ ] Industrial (manufacturing, warehouse, recycling center, public works)
[ ] Laboratory
[ ] Restaurant
[ ] Retail (store, supermarket, art gallery)
[ ] Financial & communications (bank, post office, data center)

[ ] Single-family residential
[ ] Multi-unit residential (apartments, townhouses, dormitories, barracks)
[ ] Special needs housing (assisted living, long-term care)
[ ] Hotel/resort

[ ] Daycare
[ ] K-12 education
[ ] Higher education
[ ] Recreation
[ ] Library

[ ] Health care
[ ] Animal care (veterinary, kennel)
[ ] Interpretive Center (museum, nature center, aquarium, zoo)
[ ] Assembly (conference center, community center, convention center, place of worship, perf
[ ] Stadia & arenas
[ ] Public order & safety (police station, fire station, correctional facility, courthouse)
[ ] Transportation (airport, train station, bus station)

[ ] Park (greenway, recreation space, wildlife)
[ ] Campus (corporate campus, school)
[ ] Community (neighborhood, residential development)
[ ] Military base
[ ] Regional plan

[ ] Other _____

Program spaces

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?ProgramSpaces

Select all the apply, and list approximate % of total project.

Indoor spaces

Animal care [ ] %
Cafeteria [ ] %
Child care [ ] %
Circulation [ ] %
Classroom [ ] %
Conference [ ] %
Data processing [ ] %
Detention [ ] %
Dining [ ] %
Elder care [ ] %
Electrical systems [ ] %
Greenhouse [ ] %
Gymnasium [ ] %
Laboratory [ ] %
Living quarters [ ] %
Lobby/reception [ ] %
Manufacturing [ ] %
Mechanical systems [ ] %
Medical treatment [ ] %
Office [ ] %
Public assembly [ ] %
Restrooms [ ] %
Retail food [ ] %
Retail general [ ] %
Structured parking [ ] %
Warehouse [ ] %
Other [ ] %

Outdoor spaces

Athletic field [ ] %
Drives/roadway [ ] %
Garden—decorative [ ] %
Garden—productive [ ] %
Golf course [ ] %
nterpretive landscape [ ] %
Parking [ ] %
Pedestrian/non-motorized vehicle path [ ] %
Playground [ ] %
Wildlife habitat [ ] %
Patio/hardscape [ ] %
Shade structures/outdoor rooms [ ] %
Restored landscape [ ] %
Other [ ] %

Descriptions

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?DescriptionScreen

Enter a short description of this project (fewer than 100 words).*

Enter a description of the significant environmental aspects of this project (fewer than 200 words).*

Keywords

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?KeywordsScreen

Process

- [ ] Integrated te
- [ ] Training
- [ ] Simulation
- [ ] Contracting
- [ ] Performance measurement and verification
- [ ] Design charrette
- [ ] Green framework
- [ ] Green specifications
- [ ] Commissioning
- [ ] Operations and maintenance

Community

- [ ] Transportation benefits
- [ ] Open space preservation
- [ ] Brownfield redevelopment

Site & Water

- [ ] Wildlife habi
- [ ] Indegenous vegetation
- [ ] Water harvesting
- [ ] Efficient irrigation
- [ ] Graywater
- [ ] Wetlands
- [ ] Stormwater management
- [ ] Efficient fixtures and appliances
- [ ] Drought-tolerant landscaping
- [ ] Wastewater treatment

Energy

- [ ] Massing and orientation
- [ ] Glazing
- [ ] Passive solar
- [ ] Lighting control and daylight harvesting
- [ ] On-site renewable electricity
- [ ] Insulation levels
- [ ] Airtightness
- [ ] HVAC
- [ ] Efficient lighting
- [ ] Cogeneration

Materials

- [ ] Adaptable design
- [ ] Benign materials
- [ ] Recycled materials
- [ ] Certified wood
- [ ] Occupant recycling
- [ ] Durability
- [ ] Salvaged materials
- [ ] Local materials
- [ ] C&D waste management

Indoor Environment

- [ ] Connection t
- [ ] Natural ventilation
- [ ] Moisture control
- [ ] Noise control
- [ ] Indoor air quality monitoring
- [ ] Daylighting
- [ ] Ventilation effectiveness
- [ ] Thermal comfort
- [ ] Low-emitting materials

Project Team

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?ProjectTeam

(Add contact information for any of the roles below using the "Contacts" sheet.)

Design team*

Check all roles represented on the design team and list individual and/or firm if possible.

[ ]	Architect	_____
[ ]	Civil engineer	_____
[ ]	Commissioning agent	_____
[ ]	Contractor	_____
[ ]	Electrical engineer	_____
[ ]	Environmental building consultant	_____
[ ]	Energy consultant	_____
[ ]	Facility manager	_____
[ ]	IEQ consultant	_____
[ ]	Interior designer	_____
[ ]	Landscape architect	_____
[ ]	Lighting designer	_____
[ ]	Mechanical engineer	_____
[ ]	Owner/developer	_____
[ ]	Plumbing engineer	_____
[ ]	Structural engineer	_____
[ ]	Waste management consultant	_____
[ ]	Other	_____

Additional contacts

Primary information contact:	_____
Contact for visuals:	_____
Database administration contact:	_____
Tour contact:	_____
Other contacts:	_____

* Required field

Contacts

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?ContactInfo

Add a new contact (replicate this page to list additional contacts)

First name*: _____ Middle name: _____

Last name*: _____ Salutation: _____ Suffix: _____

Organization*: _____ (either first & last name OR organization are required)

Organization acronym: _____

Address _____

City*: _____ State*: _____

Zip; postal code: _____ Country: _____

Phone: _____ Ext.: _____ Fax: _____

Mobile phone/pager: _____

Email: _____

Web site: _____

Information specific to this project

Tour contact? _____ (yes; no)

Primary contact? _____ (yes; no)

Publish full contact info?* _____ (yes; no)

Design team role: _____ If other, specify: _____

(Architect; Civil engineer; Commissioning agent; Contractor; Electrical engineer; Environmental building consultant; Energy consultant; IEQ consultant; Facility manager; Interior designer; Landscape architect; Lighting designer; Mechanical engineer; Owner/developer; Plumbing engineer; Structural engineer; Waste management consultant; Other)

Additional role(s) and/or role title: _____

Additional information for internal use only

Area of expertise: _____

(process; land-use; site & water; energy; indoor environment; materials; visuals; rating systems; costs)

Database contact? _____ (yes; no)

Visuals contact? _____ (yes; no)

Notes

Finances

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?FinancesScreen

Description of finances

Describe how the project was financed, and provide details on innovative or nonstandard financing approaches that were instrumental for this project.

Financing mechanisms

Check all that apply.

Credit enhandment

- [ ] Loan guarantees-public
- [ ] Loan guarantees-private

Equity

- [ ] Cash
- [ ] Government appropriation
- [ ] Historic tax credits
- [ ] Affordable housing tax credits
- [ ] Green building tax credits
- [ ] Other tax credits

Grant

- [ ] Public agency
- [ ] Private (foundation)

Loans

- [ ] Public institution
- [ ] Private (bank, insurance)
- [ ] Bond

Procurement process

- [ ] Design-bid-build
- [ ] Design-build
- [ ] Performance based contracts

Cost Data

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?CostScreen

Project costs

Currency units _____ (required)
Conversion factor to U.S. dollars
(dollars/other currency) _____ (required)
Total project cost (land excluded) _____
Property acquisition cost _____

Cost breakdown per unit area

Choose a unit of area for hard and soft costs
(Hard and soft costs are per ft2 or per m2) _____ [ft2; m2]

Soft costs (per unit area of building):
Professional fee _____
Management fee _____
Financing _____
Total soft cost _____
Hard costs (per unit area of building):
Site work _____
Construction _____
Tenant improvements _____
Total hard cost _____

Sum of total soft and total hard costs _____

Cost and payback description

Describe unusual project cost issues and provide estimated payback of any investment in green measures.

Land Use & Community

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?LandUseScreen

Land use description

Describe how land-use and community- or masterplan-scale issues are addressed in this project.

Featured Land Use & Community Strategies

To view strategy options, view the HPB entry forms online.

Strategy 1 _____
Strategy 2 _____
Strategy 3 _____
Strategy 4 _____
Strategy 5 _____
Strategy 6 _____
Strategy 7 _____
Strategy 8 _____
Strategy 9 _____
Strategy 10 _____

Site & Water

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?SiteScreen

Site size

Lot size _____ [ft2; m2; acres; ha]

Building footprint _____ (ft2/m2)

Site conditions*

Check as many as apply.

[ ] Pristine land (greenfield)
[ ] Previously undeveloped land
[ ] Previously developed land
[ ] Brownfield site
[ ] Wetlands
[ ] Lake/pond
[ ] Running water
[ ] Sensitive habitat
[ ] Agricultural land
[ ] Preexisting structure(s)

Site description

Describe environmental aspects of the project's site selection, land development, and landscaping.

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?SiteWater

Water conservation and use

Describe strategies and technologies that contribute to the conservation of fresh water resources.

Indoor potable water use _____ [gallons/liters] per year

Outdoor potable water use _____ [gallons/liters] per year

Total potable water use [gallons/liters] per year

Featured Site & Water Strategies

To view strategy options, view the HPB entry forms online.

Strategy 1 _____

Strategy 2 _____

Strategy 3 _____

Strategy 4 _____

Strategy 5 _____

Strategy 6 _____

Strategy 7 _____

Strategy 8 _____

Strategy 9 _____

Strategy 10 _____

Energy

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?EnergyScreen

Energy use description*

Describe how energy-related issues are addressed in this project. Note that in order for your project description to be displayed on the Department of Energy's Web site, you must also provide energy data, including, at a minimum, total energy use and data sources and reliability.

Energy security

Describe on-site electricity generation capabilities and other project features that might provide emergency power and contribute to energy security within the project and throughout the region.

Data sets (mulitple data sets can be entered)

Type: _____ [Actual--utility bills;
Actual--end-use metering;
Actual & simulation hybrid;
Simulation;
Simulation--90.1 regulated loads only;
Base case: ASHRAE 90.1;
Base case: California Title 24;
Base case: 10 CFR 434;
Base case: 90.1 regulated loads only;
Base case: CBECS Database;
Base case: other (specify);
Other: specify custom label]

Name: _____
Year: _____
Default: _____ [yes; no]
Publish: _____ [yes; no]

Summary energy data

Total annual building energy consumption

Fuel	Amount	Units	Cost($)
Total Purchased	_____	[kWh; MJ; MMBtu]	
Total On-Site Renewal		[kWh; MJ; MMBtu]	

Building energy load

Load	Amount	Units
Cooling load	_____	[ton; kW]
Heating load	_____	[kBtu/hr; kW]
Connected lighting		kW

Data sources and reliability*

If based on simulation, list software and version.

If based on utility bills, list company(s) and dates of bills.

* Required field

Comments on data source and reliability:

If monthly energy data is available, please e-mail it to hpbdata@buildinggreen.com as a spreadsheet or text file.

Featured Energy Strategies

To view strategy options, view the HPB entry forms online.

Strategy 1 _____
Strategy 2 _____
Strategy 3 _____
Strategy 4 _____
Strategy 5 _____
Strategy 6 _____
Strategy 7 _____
Strategy 8 _____
Strategy 9 _____
Strategy 10 _____
Strategy 11 _____
Strategy 12 _____
Strategy 13 _____
Strategy 14 _____
Strategy 15 _____
Strategy 16 _____
Strategy 17 _____
Strategy 18 _____
Strategy 19 _____
Strategy 20 _____

Energy Worksheet--For Detailed Energy Data

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?EnergyScreen

Data sets (mulitple data sets can be entered)

Type: _____ [Actual--utility bills;
Actual--end-use metering;
Actual & simulation hybrid;
Simulation;
Simulation--90.1 regulated loads only;
Base case: ASHRAE 90.1;
Base case: California Title 24;
Base case: 10 CFR 434;
Base case: 90.1 regulated loads only;
Base case: CBECS Database;
Base case: other (specify);
Other: specify custom label]

Name: _____
Year: _____
Default: _____ [yes; no]
Publish: _____ [yes; no]

Building area

	Area	Units
Gross floor area	[Value from General screen]	
Heated floor area	_____	[ft2; m2]
Cooled floor area	_____	[ft2; m2]

Annual building energy consumption

Purchased energy

Fuel	Amount	Units	Cost ($)
Electricity	_____	kWh	_____
Natural gas	_____	[kWh; MMBtu; MJ]	_____
Other	_____	[kWh; MMBtu; MJ]	_____
Other	_____	[kWh; MMBtu; MJ]	_____

Annual on-site renewable generation

Source	Amount	Units
PV	_____	[kWh; MMBtu; MJ]
Solar thermal	_____	[kWh; MMBtu; MJ]
Wind	_____	[kWh; MMBtu; MJ]
Other	_____	[kWh; MMBtu; MJ]

Annual end use breakdown

End use	Amount	Units	
Heating		[kWh; MMBtu; MJ]	
Cooling		[kWh; MMBtu; MJ]	
Lighting		[kWh; MMBtu; MJ]	
Fans & pumps		[kWh; MMBtu; MJ]	
Plug loads & equipment		[kWh; MMBtu; MJ]	
Vertical transport		[kWh; MMBtu; MJ]	
Domestic hot water		[kWh; MMBtu; MJ]	
Other end use		[kWh; MMBtu; MJ]	(specify)

Purchased electricity fuel mix

Fuel	% of total	
Coal		
Fuel oil		
Natural gas		
Nuclear		
Hydroelectric		
Other		(specify)

Peak power

Fuel	Amount	Units
Electricity (summer)		kW
Electricity (winter)		kW
Natural gas		[kBtu/hr; kW]

Building energy load

Load	Amount	Units
Cooling load		[ton; kW]
Heating load		[kBtu/hr; kW]
Connected lighting		kW

Data sources and reliability*

If based on simulation, list software and version.

If based on utility bills, list company(s) and dates of bills.

Comments on data source and reliability:

If monthly energy data is available, please e-mail it to hpbdata@buildinggreen.com as a spreadsheet or text file.

Materials & Resources

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?MaterialsScreen

Materials & resources descriptions

Describe how issues relating to material use, resource efficiency, and product selection are addressed in this project.

Provide any available data on diversion of construction and demolition waste from disposal. Include a description of how this diversion was accomplished.

Green materials (products)

List notable green products here, with manufacturer and product name.

Design for adaptability to future uses

Describe any aspects of the design or construction of the project that enhance its potential for reuse in the future.

Featured Materials & Resources Strategies

For strategy options, view the HPB entry forms online.

Strategy 1 _____
Strategy 2 _____
Strategy 3 _____
Strategy 4 _____
Strategy 5 _____
Strategy 6 _____
Strategy 7 _____
Strategy 8 _____
Strategy 9 _____
Strategy 10 _____

Indoor Environment

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?IndoorEnvironment

Indoor environment approach

Describe how indoor-environment-related issues are addressed in this project.

Featured Indoor Environment Strategies

For strategy options, view the HPB entry forms online.

Strategy 1 _____

Strategy 2 _____

Strategy 3 _____

Strategy 4 _____

Strategy 5 _____

Strategy 6 _____

Strategy 7 _____

Strategy 8 _____

Strategy 9 _____

Strategy 10 _____

Results

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?ResultsScreen

Lessons learned

Discuss goals that were met and goals that were not achieved, and the reasons for these outcomes.

Ratings

List any ratings of this project. List points or credits achieved on a separate sheet.

Rating program/version _____
Year _____
Level achieved _____

Rating program/version _____
Year _____
Level achieved _____

Awards

List any awards associated with this project.

Award program/version _____
Year _____
Category/title _____

Award program/version _____
Year _____
Category/title _____

Award program/version _____
Year _____
Category/title _____

Visuals (replicate this page to include additional visuals)

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?VisualsScreen

Permission

I provide unrestricted use of this digital image, in print and electronic formats, with appropriate credit as specified on the following screen. I represent and warrant that I have the full right and authority to grant the rights herein granted, that all the necessary releases have been procured, and that no one else's permission is required.

I agree _____ Upload without permission _____

Project file information

Title _____

NREL Pix number _____

Display section _____ [visuals only; overview; process; land use; site/water; energy; materials; indoor environment]

Permission* _____ [yes; no]

Permission comments

Caption*

Source

Credits

Notes

* Required field

Learn More

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?LearnScreen

Visiting options

Visiting the project

Is it possible to visit this project? [yes; no]

If so, please provide as many details as possible (street address, directions, times).

Guided tours

Are guided tours available? [yes; no]

If so, please provide relevant details.

Tour contact information:

References

(Use separate form to describe any references for additional information on this project.)

Data reliability

Comments from data provider, editor, and/or reviewer on the quality and reliability of any information provided on this form. Please include a date with any notes. Not for publication.

The information provided here is valid as of: _____

References

Online help: http://www.BuildingGreen.com/cgi-bin/hpbwiki.pl?ReferenceInfo

Add a new reference (replicate this page to list additional references)

Title* _____ (required)

Subtitle _____

Author 1 first name _____

Author 1 last name _____

Author 2 first name _____

Author 2 last name _____

Author 3 first name _____

Author 3 last name _____

_____ [author; editor]

ISBN _____

Reference type* _____

[magazine; book; CD-ROM; Web site; other--specified]

Please indicate below the book, magazine, or Web site (if any) in which this reference appears.

Publication _____

Publisher _____

Publication Date _____

Volume _____

Issue _____

Page _____

URL _____ File size _____ [KB/MB]

Description